9-1285-200-30-1

TM 9-1285-200-30-1

TECHNICAL MANUAL

CONTACT TEAM MANUAL

FOR

RADAR SET AN/VPS-2
(1285-00-087-4746 OR 1285-00-179-4218)

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1983

D 101.11:

WARNING

HAZARDOUS VOLTAGE
is used in the operation of this equipment
DEATH ON CONTACT
may result if maintenance personnel fail to observe safety precautions. Learn the areas containing hazardous voltage in each piece of equipment. Be careful not to contact high voltage or 115-volt ac input connections when testing or operating this equipment. Before working inside the equipment, turn power OFF and ground points of high potential before touching them.

WARNING

ELECTROMAGNETIC RADIATION
A potential radiation hazard exists when the radar is energized and transmitting. Stay at least three feet away from the center of the antenna when the radar is transmitting. For first aid for soldiers refer to FM21-11.

TECHNICAL MANUAL
No. 9-1285-200-30-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C. 22 March 1983

Contact Team Manual
for
RADAR SET AN/VPS-2
(1285-00-087-4746 OR 1285-00-179-4218)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished to you.

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*This manual together with TM 9-1285-200-30, 29 April 1983, supersedes TM 9-1285-200-30/1, 30 December 1975; TM 9-1285-200-30/2, 30 December 1975 and TM 9-1285-200-34/3, 26 January 1972.

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CHAPTER 1

INTRODUCTION

Section 1. GENERAL

1-1. Scope. This manual is for your use in operating and maintaining the Radar Set AN/VPS-2. This manual is designed to help you make the right fault choice the first time. While it does not list every possible type of trouble that can occur, it does make use of observable symptoms to rapidly isolate troubles to small areas. As a Contact Team member, you will be equipped with an oscilloscope, multimeter, radar system tester, and an antenna alignment test set. The oscilloscope is your most important tool. This manual is not designed to replace existing technical manuals. Rather, it is a supplement to the existing radar technical manuals.

1-2. Maintenance Forms and Records. Maintenance forms and records which you are required to use are listed and explained in TM 38-750.

1-3. Reporting Equipment Improvement Recommendation (EIR). EIR's will be prepared using SF368, Quality Deficiency Report (QDR). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System (TAMMS). EIR's should be mailed directly to Commander, U.S. Army Armament Materiel Readiness Command, ATTN: DRSAR-MAO, Rock Island, IL 61299. A reply will be furnished directly to you.

1-4. How to Use This Manual. This manual is designed to permit you to rapidly isolate troubles occurring in Radar Set AN/VPS-2. To obtain the most efficient use of the information presented here, you should be aware of the following information:

a. Do not assume anything. Misleading symptoms can cause you to troubleshoot the wrong portions of the radar. The radar system checkout procedure in Chapter 2 contains clearly observable and distinct symptoms arranged so that the right choice is made quickly and easily.

b. To use this manual as a troubleshooting aid, begin by performing the system checkout procedure of figure 2-1. As you proceed through the steps, the answers to the questions asked provide you with two logical paths. The YES path indicates that the system is functioning correctly. On the other hand, a NO indication would be obtained when the system is malfunctioning. Malfunctions can be readily found by relating this symptom to the troubleshooting contained in other chapters.

c. The functional diagrams illustrate typical oscilloscope waveforms at significant test points. Appropriate sweep speed and voltage settings are provided alongside the waveform together with synchronous data. These settings must be observed to duplicate the waveforms illustrated. Note that the SLOPE control on the oscilloscope, which determines where the oscilloscope will trigger, should be in the + (positive) position for positive-going waveforms and in the - (negative) position for negative-going waveforms. When checking the gates that sweep across the scope, the SLOPE switch will determine if the gate sweep is from left to right or right to left.

d. If the low-capacity X10 probe is used, check that the frequency compensation circuit of the probe is adjusted correctly to avoid distortion in waveform display.

e. Common nomenclature used in this manual is listed in TM 9-1285-200-30.

Section II. DESCRIPTION AND TABULATED DATA

1-5. Description. Refer to TM 9-1285-200-30 for a detailed description of the radar.

1-6. Tabulated Data. Refer to TM 9-1005-286-20-1 or TM 9-2350-300-20-1 for a list of tabulated data for the radar set.

1-7. Repair Parts, Special Tools, TMDE and Support Equipment. Refer to TM 9-1285-200-30P for repair parts, special tools, TMDE, and support equipment lists.

CHAPTER 2

SYSTEM TROUBLE ANALYSIS

2-1. Introduction. This chapter contains the fault localization diagrams you will use to evaluate the AN/VPS-2 radar system and localize a failure to a subsystem. Whenever a radar system is reported defective, you should start by troubleshooting the system using figure 2-1. By following the blocks in figure 2-1, you can rapidly determine if the radar system is operational. When a NO response is obtained, the block where the error occurs will direct you to the defective subsystem or to another trouble analysis figure. If directed to another trouble analysis figure, use it the same as you did figure 2-1 to determine which subsystem is defective. Always return to figure 2-1 to complete the entire checkout of a radar.

2-2. System Troubleshooting. The system troubleshooting diagram, figure 2-1, will be used to evaluate overall radar system operation. The diagram will aid you in determining whether a failure is due to a subsystem defect or operator error. If another figure is to be used in conjunction with the troubleshooting diagram to isolate a fault, perform all steps on figure 2-1 after repairing the trouble.

2-3. Computer Unit 4 Localization

a. The computer unit 4 fault localization diagram, figure 2-2, will be used when the computer unit 4 is not searching as noted in block 7 of figure 2-1. The diagram will aid you in determining if the error is in the computing subsystem or the receiving subsystem.

b. The computer unit 4 fault localization diagram, figure 2-3, will be used when mid-range calibration cannot be obtained as noted in block 8 of figure 2-1. The diagram will aid you in localizing the error to the transmitting subsystem, receiving subsystem, or the computing subsystem.

c. On occasion, a trouble may be encountered that seems to defy correction. These problems usually are caused by cabling malfunctions or power difficulties. Localizing these problems can be accomplished as follows:

(1) Cabling problems. The usual problems encountered with the armor-jacketed interconnecting cables are intermittent ones. For example, W105 connects the receiver unit 3 to the computer unit 4 and the receiver/transmitter (R/T) unit 2 through coaxial leads. A problem that can occur is that mid-range calibration cannot be obtained. Replacement of cards in the computer unit 4 and even replacement of both the receiver unit 3 and the computer unit 4 fails to remedy the problem. Try moving the cabling by turning the units and connectors, unless a spare cable is available and a substitution can be made. Within the units, if you have isolated the trouble to an area, move the cables and check that all are connected securely.

(2) Power problems. Noise in the power source usually is filtered out by the batteries, and is not a factor in trouble analysis. However, noise will cause the computer unit 4 to lock up and stay in the track mode when the MODE switch is in NORM, but not when the switch is in TEST. Noise can also degrade radar system sub clutter visibility and cause the radar to fail the maximum clutter check of the AN/VPM-2 system tester. With three sources of power in the M163A1 (engine, battery and APU) and two sources of power in

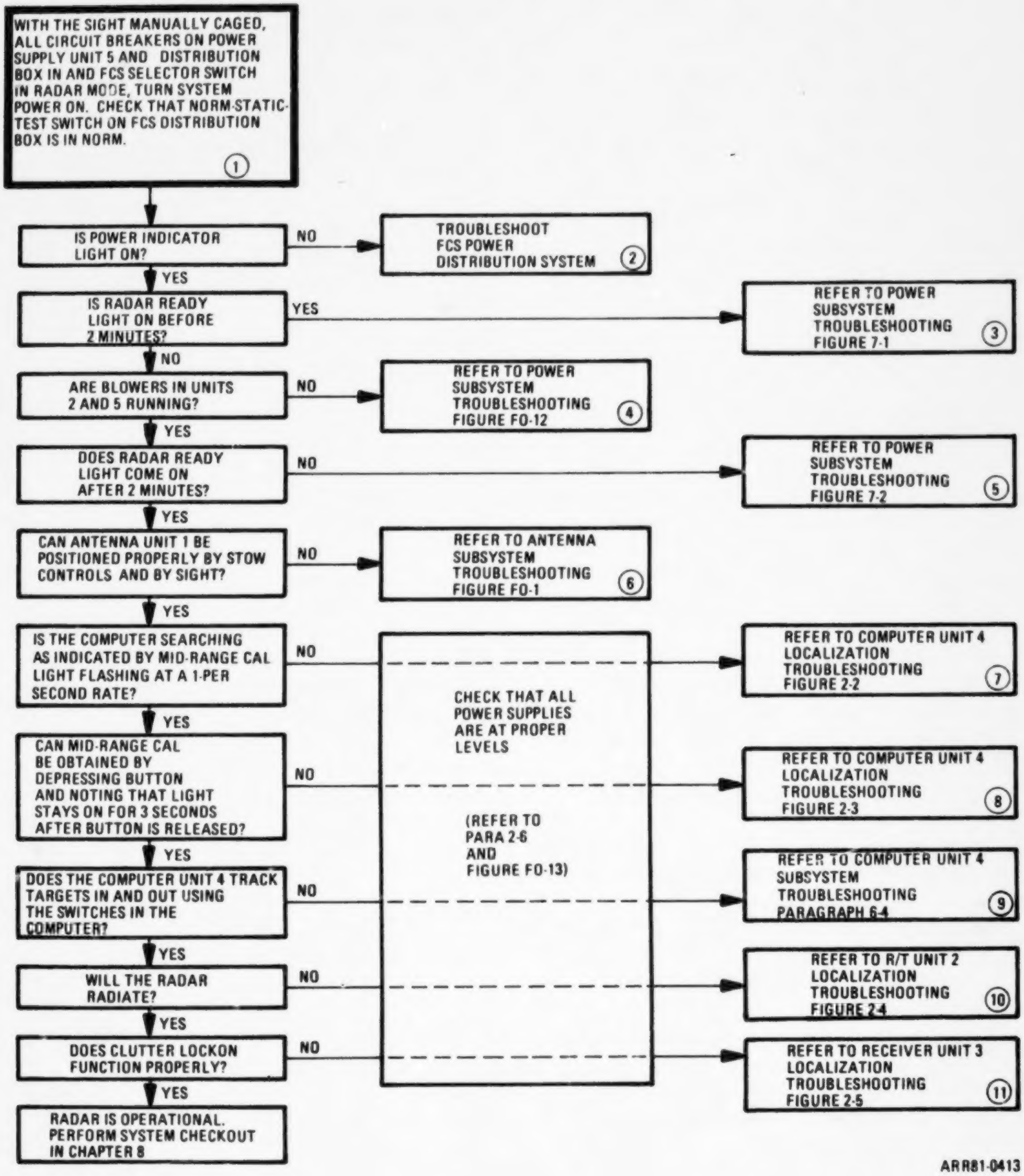
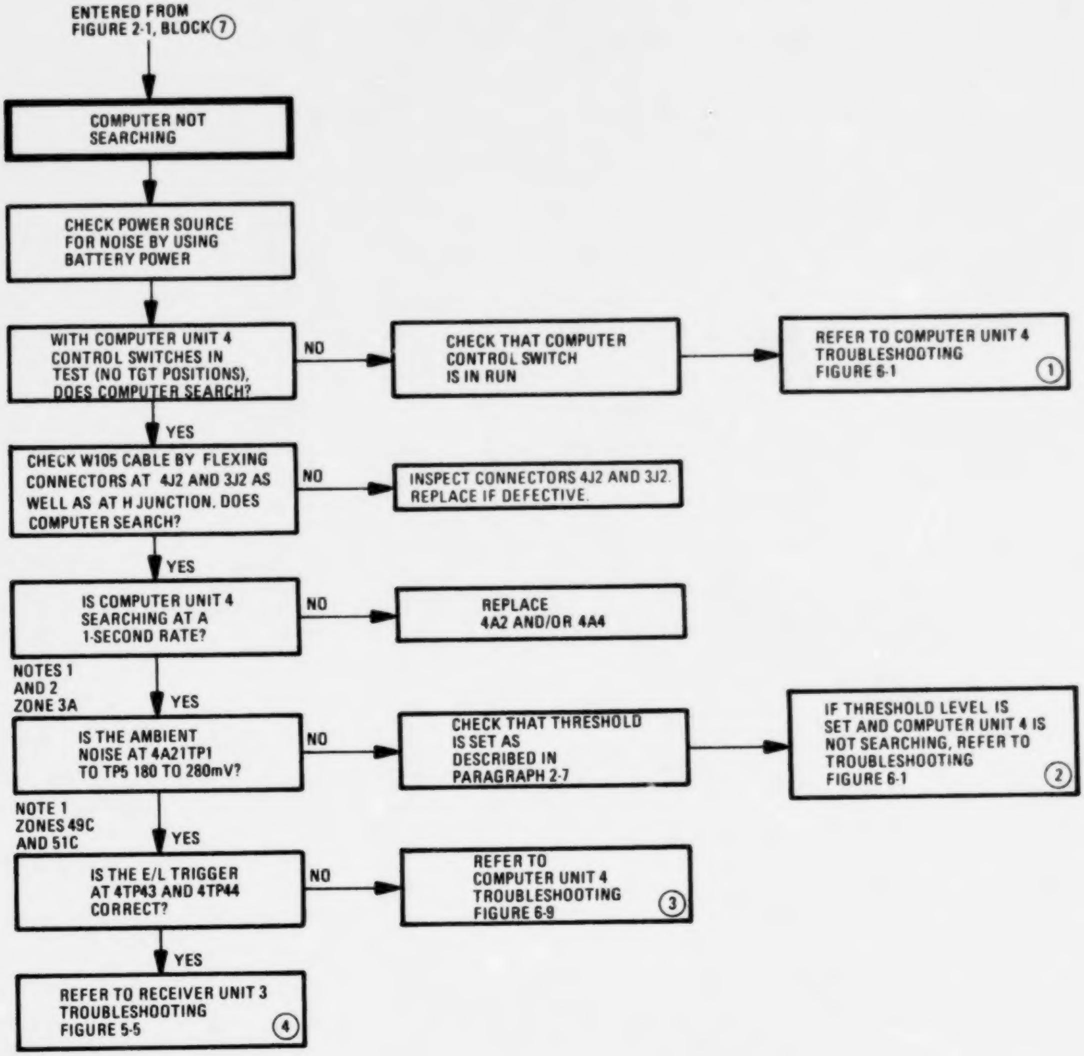

WITH THE SIGHT MANUALLY CAGED, ALL CIRCUIT BREAKERS ON POWER SUPPLY UNIT 5 AND DISTRIBUTION BOX IN AND FCS SELECTOR SWITCH IN RADAR MODE, TURN SYSTEM POWER ON. CHECK THAT NORM-STATIC-TEST SWITCH ON FCS DISTRIBUTION BOX IS IN NORM. ①
IS POWER INDICATOR LIGHT ON?
NO
TROUBLESHOOT FCS POWER DISTRIBUTION SYSTEM ②
YES
IS RADAR READY LIGHT ON BEFORE 2 MINUTES?
YES
REFER TO POWER SUBSYSTEM TROUBLESHOOTING FIGURE 7-1 ③
NO
ARE BLOWERS IN UNITS 2 AND 5 RUNNING?
NO
REFER TO POWER SUBSYSTEM TROUBLESHOOTING FIGURE FO-12 ④
YES
DOES RADAR READY LIGHT COME ON AFTER 2 MINUTES?
NO
REFER TO POWER SUBSYSTEM TROUBLESHOOTING FIGURE 7-2 ⑤
YES
CAN ANTENNA UNIT 1 BE POSITIONED PROPERLY BY STOW CONTROLS AND BY SIGHT?
NO
REFER TO ANTENNA SUBSYSTEM TROUBLESHOOTING FIGURE FO-1 ⑥
YES
IS THE COMPUTER SEARCHING AS INDICATED BY MID-RANGE CAL LIGHT FLASHING AT A 1-PER SECOND RATE?
NO
REFER TO COMPUTER UNIT 4 LOCALIZATION TROUBLESHOOTING FIGURE 2-2 ⑦
CHECK THAT ALL POWER SUPPLIES ARE AT PROPER LEVELS
(REFER TO PARA 2-6 AND FIGURE FO-13)
YES
CAN MID-RANGE CAL BE OBTAINED BY DEPRESSING BUTTON AND NOTING THAT LIGHT STAYS ON FOR 3 SECONDS AFTER BUTTON IS RELEASED?
NO
REFER TO COMPUTER UNIT 4 LOCALIZATION TROUBLESHOOTING FIGURE 2-3 ⑧
YES
DOES THE COMPUTER UNIT 4 TRACK TARGETS IN AND OUT USING THE SWITCHES IN THE COMPUTER?
NO
REFER TO COMPUTER UNIT 4 SUBSYSTEM TROUBLESHOOTING PARAGRAPH 6-4 ⑨
YES
WILL THE RADAR RADIATE?
NO
REFER TO R/T UNIT 2 LOCALIZATION TROUBLESHOOTING FIGURE 2-4 ⑩
YES
DOES CLUTTER LOCKON FUNCTION PROPERLY?
NO
REFER TO RECEIVER UNIT 3 LOCALIZATION TROUBLESHOOTING FIGURE 2-5 ⑪
YES
RADAR IS OPERATIONAL. PERFORM SYSTEM CHECKOUT IN CHAPTER 8
ARR81-0413

Figure 2-1. AN/VPS-2 system troubleshooting


ENTERED FROM FIGURE 2-1, BLOCK ⑦
COMPUTER NOT SEARCHING
CHECK POWER SOURCE FOR NOISE BY USING BATTERY POWER
WITH COMPUTER UNIT 4 CONTROL SWITCHES IN TEST (NO TGT POSITIONS), DOES COMPUTER SEARCH?
NO
CHECK THAT COMPUTER CONTROL SWITCH IS IN RUN
REFER TO COMPUTER UNIT 4 TROUBLESHOOTING FIGURE 6-1 ①
YES
CHECK W105 CABLE BY FLEXING CONNECTORS AT 4J2 AND 3J2 AS WELL AS AT H JUNCTION. DOES COMPUTER SEARCH?
NO
INSPECT CONNECTORS 4J2 AND 3J2. REPLACE IF DEFECTIVE.
YES
IS COMPUTER UNIT 4 SEARCHING AT A 1-SECOND RATE?
NO
REPLACE 4A2 AND/OR 4A4
NOTES 1 AND 2 ZONE 3A
YES
IS THE AMBIENT NOISE AT 4A21TP1 TO TP5 180 TO 280mV?
NO
CHECK THAT THRESHOLD IS SET AS DESCRIBED IN PARAGRAPH 2-7
IF THRESHOLD LEVEL IS SET AND COMPUTER UNIT 4 IS NOT SEARCHING, REFER TO TROUBLESHOOTING FIGURE 6-1 ②
NOTE 1 ZONES 49C AND 51C
YES
IS THE E/L TRIGGER AT 4TP43 AND 4TP44 CORRECT?
NO
REFER TO COMPUTER UNIT 4 TROUBLESHOOTING FIGURE 6-9 ③
YES
REFER TO RECEIVER UNIT 3 TROUBLESHOOTING FIGURE 5-5 ④
AR925498

NOTES:

1. REFER TO FIGURE FO-11
2. 4A21TP1 TO TP5 SAME AS 4TP47 TO 4TP46
3. REFER TO FIGURE 6-11 FOR TEST POINT LOCATION

Figure 2-2. Computer unit 4 not searching, fault localization diagram

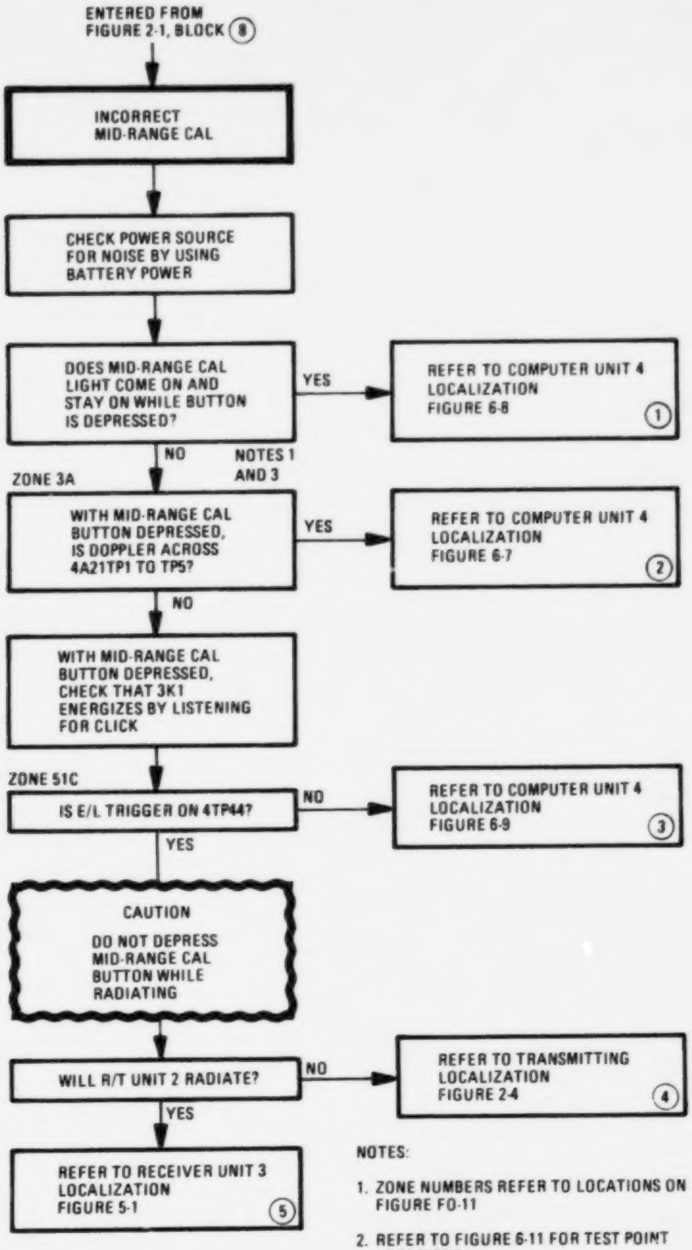

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FIGURE 2-1, BLOCK ⑧
INCORRECT MID-RANGE CAL
CHECK POWER SOURCE FOR NOISE BY USING BATTERY POWER
DOES MID-RANGE CAL LIGHT COME ON AND STAY ON WHILE BUTTON IS DEPRESSED?
YES
REFER TO COMPUTER UNIT 4 LOCALIZATION FIGURE 6-8 ①
NO
NOTES 1 AND 3
ZONE 3A
WITH MID-RANGE CAL BUTTON DEPRESSED, IS DOPPLER ACROSS 4A21TP1 TO TP5?
YES
REFER TO COMPUTER UNIT 4 LOCALIZATION FIGURE 6-7 ②
NO
WITH MID-RANGE CAL BUTTON DEPRESSED, CHECK THAT 3K1 ENERGIZES BY LISTENING FOR CLICK
ZONE 51C
IS E/L TRIGGER ON 4TP44?
NO
REFER TO COMPUTER UNIT 4 LOCALIZATION FIGURE 6-9 ③
YES
CAUTION
DO NOT DEPRESS MID-RANGE CAL BUTTON WHILE RADIATING
WILL R/T UNIT 2 RADIATE?
NO
REFER TO TRANSMITTING LOCALIZATION FIGURE 2-4 ④
YES
REFER TO RECEIVER UNIT 3 LOCALIZATION FIGURE 5-1 ⑤

NOTES:

1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-11
2. REFER TO FIGURE 6-11 FOR TEST POINT LOCATIONS.
3. SAME AS 4TP47 TO 4TP46.

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Figure 2-3. Computer unit 4 mid-range calibration incorrect, fault localization diagram

the M167A1 weapon (battery and APU) isolation is merely the removal of the APU power cable. If the system functions normally, it is a sign that there are transients in the power source of sufficient amplitude and these are at a fairly repetitive frequency.

(3) Simultaneous common troubles. This is where troubleshooting is difficult and the Contact Team is needed the most. It would be impossible for this manual to list all conceivable troubles along with all simultaneous common troubles. Therefore, you will have to start at the very beginning and work from there in logical order. Once again using our symptom of no mid-range calibration and computer locked up on noise as an example, a troubleshooting method would go something like this:

(a) Switch to battery power, ensuring that the power output is between 22 and 30 Vdc. If the computer unit 4 goes into the search mode, the APU is generating some noise that is entering the system. If not, refer to figure 2-2.

(b) If mid-range calibration cannot be obtained, try moving that part of cable W105 connected between 3J2 and 4J4. If this corrects the problem, check cable W105, and inspect connectors 3J2 and 4J4 for excessive wear. If not, refer to figure 2-3.

2-4. Receiver/Transmitter Unit 2 Localization. The transmitting localization diagram, figure 2-4, will be used when the radar will not radiate as noted in block 10 of figure 2-1. The diagram will aid you in localizing the error to the computing subsystem, power distribution subsystem or transmitting subsystem.

2-5. Receiver unit 3 Localization. The receiver unit 3 localization diagram, figure 2-5, will be used when clutter lock-on will not function as noted in block 11 of figure 2-1. The diagram will aid you in localizing the error to the computing subsystem, power distribution subsystem, or receiving subsystem.

2-6. Voltage Measurements. When performing the voltage measurements as directed in figure 2-1, proceed as follows:

a. Turn SYSTEM POWER toggle switch on the fire control system (FCS) control panel to OFF.

b. Remove computer unit 4 from case and place unit on top of case.

c. Remove W103P1 from 5J4.

d. Connect the AN/TPM-23 voltage tester W1 between 5J4 and W103P1.

e. Set the NORM STATIC TEST switch on the distribution box A1 to STATIC.

f. Set the SYSTEM POWER toggle switch on the FCS control panel to ON. SYSTEM POWER indicator will illuminate.

g. Measure the power supply output voltages using the multimeter and voltage tester W1. Table 2-1 lists each point of measurement and corresponding multimeter indication.

h. At the computer unit 4, use the multimeter to measure input and output voltages of 5-volt filter 4A18, 15-volt regulator 4A19, and 25-volt regulator 4A20. Table 2-2 lists each point of measurement and the corresponding multimeter indication. Figure 6-11 locates the voltage test points in the computer unit 4.

i. Set the SYSTEM POWER toggle switch on the FCS control panel to OFF.

j. Disconnect and stow voltage tester W1.

k. Reconnect cable W103 to the power supply unit 5.

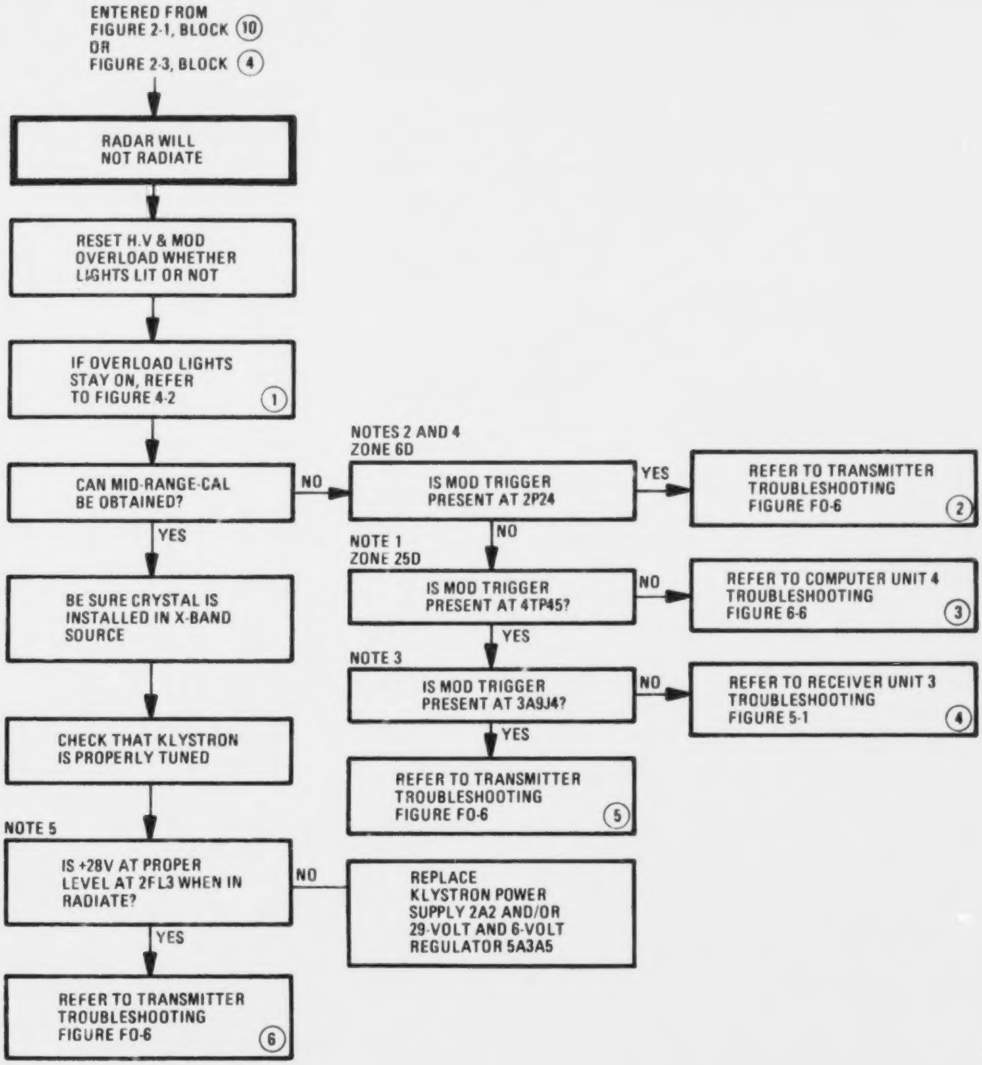
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FIGURE 2-1, BLOCK ⑩
OR
FIGURE 2-3, BLOCK ④
RADAR WILL NOT RADIATE
RESET H.V & MOD OVERLOAD WHETHER LIGHTS LIT OR NOT
IF OVERLOAD LIGHTS STAY ON, REFER TO FIGURE 4-2 ①
CAN MID-RANGE-CAL BE OBTAINED?
NO
YES
NOTES 2 AND 4
ZONE 6D
IS MOD TRIGGER PRESENT AT 2P24
YES
REFER TO TRANSMITTER TROUBLESHOOTING FIGURE FO-6 ②
NO
NOTE 1
ZONE 25D
IS MOD TRIGGER PRESENT AT 4TP45?
NO
REFER TO COMPUTER UNIT 4 TROUBLESHOOTING FIGURE 6-6 ③
YES
NOTE 3
IS MOD TRIGGER PRESENT AT 3A9J4?
NO
REFER TO RECEIVER UNIT 3 TROUBLESHOOTING FIGURE 5-1 ④
YES
REFER TO TRANSMITTER TROUBLESHOOTING FIGURE FO-6 ⑤
BE SURE CRYSTAL IS INSTALLED IN X-BAND SOURCE
CHECK THAT KLYSTRON IS PROPERLY TUNED
NOTE 5
IS +28V AT PROPER LEVEL AT 2FL3 WHEN IN RADIATE?
NO
REPLACE KLYSTRON POWER SUPPLY 2A2 AND/OR 29-VOLT AND 6-VOLT REGULATOR 5A3A5
YES
REFER TO TRANSMITTER TROUBLESHOOTING FIGURE FO-6 ⑥

NOTES:

1. REFER TO FIGURE FO-10
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 4-4
3. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
4. REFER TO FIGURE FO-8 FOR WAVEFORM
5. REFER TO FIGURE 7-5

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Figure 2-4. Receiver/transmitter unit 2, fault localization diagram

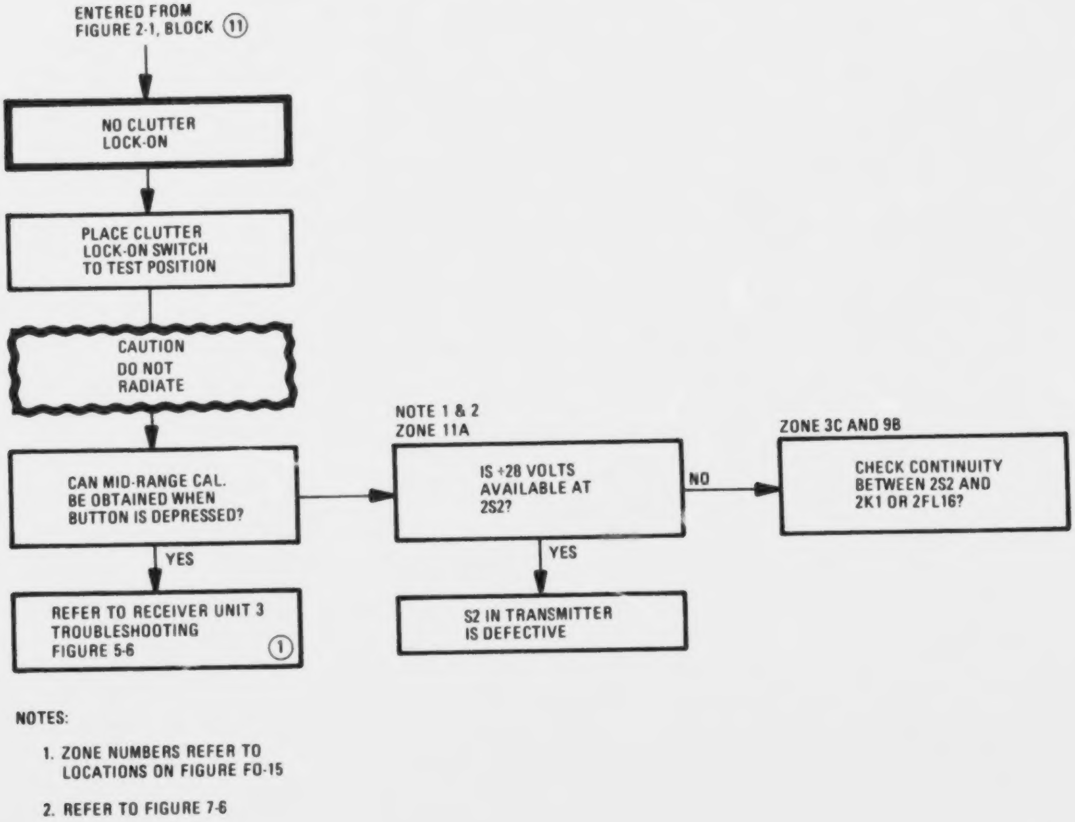

ENTERED FROM
FIGURE 2-1, BLOCK ⑪
NO CLUTTER LOCK-ON
PLACE CLUTTER LOCK-ON SWITCH TO TEST POSITION
CAUTION
DO NOT RADIATE
CAN MID-RANGE CAL. BE OBTAINED WHEN BUTTON IS DEPRESSED?
YES
REFER TO RECEIVER UNIT 3 TROUBLESHOOTING FIGURE 5-6 ①
NOTE 1 & 2
ZONE 11A
IS +28 VOLTS AVAILABLE AT 2S2?
NO
YES
S2 IN TRANSMITTER IS DEFECTIVE
ZONE 3C AND 9B
CHECK CONTINUITY BETWEEN 2S2 AND 2K1 OR 2FL16?
NOTES:
1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-15
2. REFER TO FIGURE 7-6
AR925501

Figure 2-5. Receiver unit 3, fault localization diagram

Table 2-1. Power Supply Unit 5, Output Voltage

Multimeter connection		Multimeter indication (Vdc)
Plus (+)	Minus (-)	
+33	RET	32.7 to 33.3
RET	-33	32.7 to 33.3
+23	RET	22.8 to 23.2
RET	-23	22.8 to 23.2
+15	RET	14.8 to 15.2
RET	-15	14.8 to 15.2
+28	RET	28.7 to 29.3
+6.5	RET	6.1 to 6.7

Table 2-2. Computer Unit 4 Regulator Assemblies, Input and Output Voltages

Input/output	Multimeter connection		Multimeter indication (Vdc)
	Plus (+)	Minus (-)	
Input	TP1	E10	5.7 to 6.3
	E7	TP2	22.8 to 23.2
	TP3	E7	22.8 to 23.2
	E2	TP4	32.7 to 33.3
	TP5	E4	32.7 to 33.3
Output	E2	E1	24.7 to 25.3
	E3	E4	24.7 to 25.3
	E6	E5	14.8 to 15.2
	E8	E7	14.8 to 15.2
	E9	E10	4.75 to 5.25

l. Slide the computer unit 4 into the case. Tighten four thumbscrews on the front panel assembly.

2-7. Threshold Level Adjustment. The following adjustment is made after servicing or replacing the receiver/transmitter unit 2, receiver unit 3, or computer unit 4. This adjustment will ensure that the lock threshold setting is 7 to 8 dB over the ambient noise.

a. Ensure that the mid-range calibration circuit is working by depressing the MID-RANGE CAL button on the computer unit 4 and noting that the MID-RANGE CAL lamp illuminates for three seconds after the button is released.

b. Remove attenuator 3AT5 located on the receiver unit 3 by disconnecting 3P61 from J1 and 3P70 from J2. With the attenuator 3AT5 out of the circuit, connect 3P61 and 3P70 together into the circuit.

c. The radar will lockup on noise as evidenced by the MID-RANGE CAL lamp not blinking on the computer unit 4.

d. Locate R22 situated on the top rear-end of the phase detector 4A15.

e. Using a jewelers screwdriver, turn R22 clockwise until the MID-RANGE CAL light blinks once per second.

f. Check the setting by turning R22 one-half turn counterclockwise. The system should now lockup, as evidenced by the MID-RANGE CAL light not blinking. Turn R22 clockwise one-half turn and the MID-RANGE CAL light should blink once per second. The threshold is now adjusted to 7 to 8 dB over ambient noise.

g. Disconnect 3P61 from 3P70. Connect attenuator 3AT5 into circuit by connecting 3P61 to J1 and 3P70 to J2.

h. Check the performance of the MID-RANGE CAL circuit as described in step 2-7a. If performance is satisfactory, proceed to step 2-7i. If performance is not satisfactory, perform the following adjustments:

(1) Locate the doppler oscillator 3A11 in receiver unit 3 and adjust R10 (located on top of the oscillator housing) counterclockwise to increase the MID-RANGE CAL signal amplitude. Adjust R10 counterclockwise one-half turn at a time.

(2) Check the MID-RANGE CAL on the computer unit 4 three times to ensure function is satisfactory after each one-half turn of R10.

NOTE

Excessive signal will cause ECM indication. This will require a clockwise adjustment of 3A11R10.

i. Replace the receiver unit 3 and computer unit 4 in their cases.

CHAPTER 3

ANTENNA UNIT 1 AND DISTRIBUTION BOX UNIT 6 SUBSYSTEM FAULT LOCALIZATION

3-1. Antenna Unit 1 Fault Location. This chapter contains the fault localization diagrams you will use if the antenna unit 1 subsystem is not functioning properly, as indicated in block 6 of figure 2-1. Figure FO-1 is used to locate failures which are common to both elevation and traverse positioning. Figure FO-2 is used to locate failures isolated to elevation positioning. Figure FO-3 is used to locate failures isolated to traverse positioning. Figure FO-4 will be used when the antenna current limiting circuits are not functioning properly.

3-2. Elevation Drive 1A2 Cover Removal. For removal of the elevation drive 1A2 cover, proceed as follows:

a. Deenergize the radar by placing the SYSTEM POWER toggle switch on the control panel to OFF.

b. Remove the shield assembly covering the gun elevation coupling.

c. Disconnect the gun elevation shaft coupling from the shaft extending from the cover of elevation drive 1A2.

d. Remove and retain nine screws, lockwashers, and flat washers from cover.

e. Remove the cover and packing from elevation drive 1A2.

3-3. Traverse Drive 1A3 Cover Removal. For removal of the traverse drive 1A3 cover, proceed as follows:

a. Deenergize the radar by placing SYSTEM POWER toggle switch on FCS control panel to OFF.

b. Remove and retain eight screws, lockwashers, and flat washers from cover.

c. Remove the cover and packing from traverse drive 1A3.

3-4. Antenna Unit 1 Alignment Procedure. To check the antenna unit 1 alignment with the AN/TPM-23 test set, proceed as follows:

a. Refer to figure 3-1. When testing elevation alignment, disconnect cable W108P8 from 1A2J1. If traverse alignment is under test, disconnect W107P2 from 1A3J1.

b. For elevation, connect W108P2 to W4P2 (for traverse, connect W107-P2 to W3P2 and W3P1 to W4P2).

c. Connect W4P1 to STOW CONTROL jack J2 on the antenna test section of the AN/TPM-23 test set.

d. Connect W6P1 to ANTENNA jack J1 on the antenna test section of the AN/TPM-23 test set.

e. Connect W6P2 to 1A2J1 (for traverse, connect W6P2 to W5P1 and W5P2 to 1A3J1).

NOTE

Make sure cables do not interfere with antenna motion.

f. Set controls as listed in table 3-1.

g. Set the MAINT toggle switch on distribution box unit 6 to ON.

h. Set EL/TRAV POS dial to 0 degree. When testing elevation, set gun elevation to 0 degree.

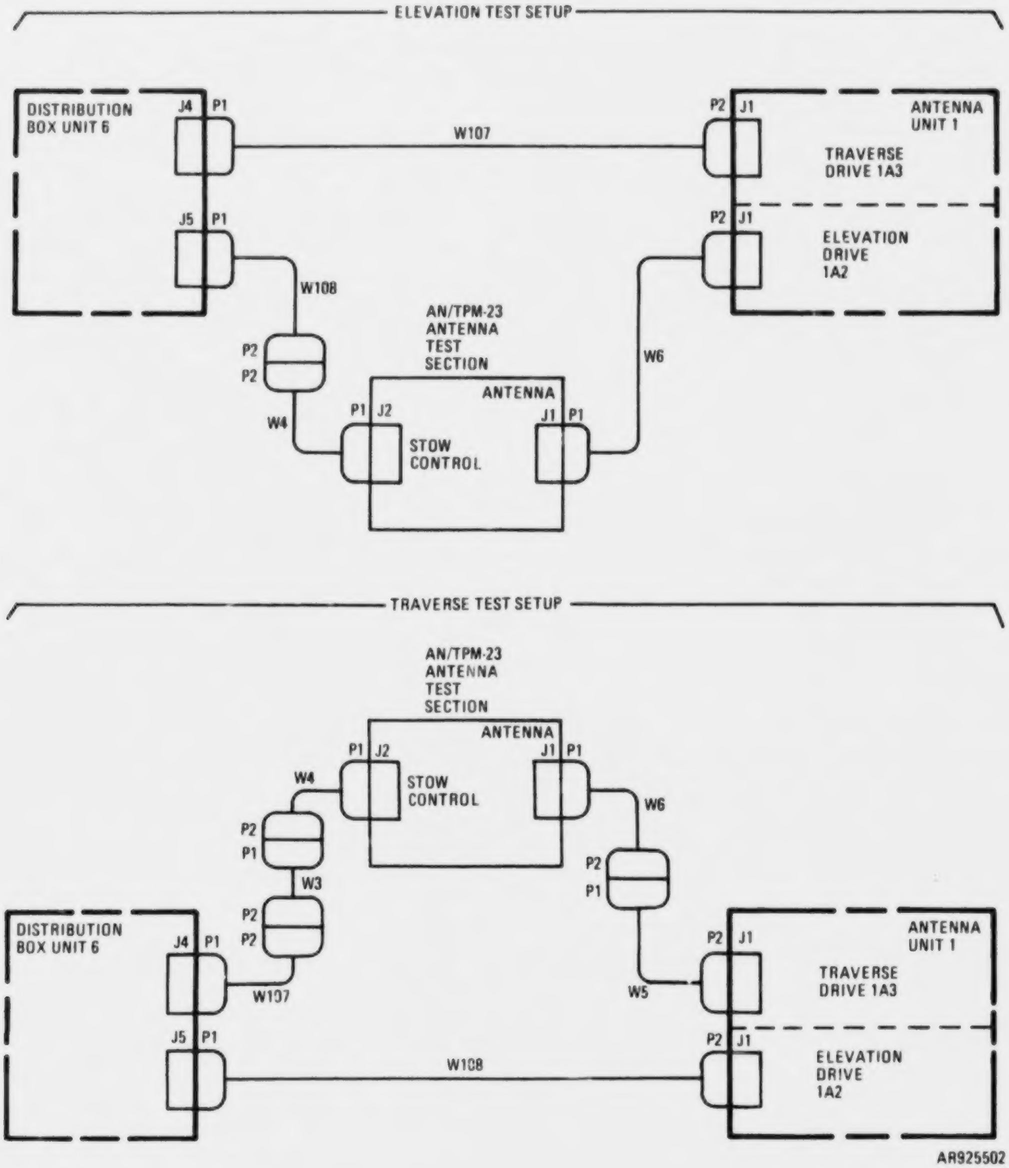

ELEVATION TEST SETUP
DISTRIBUTION BOX UNIT 6
J4
P1
J5
P1
W107
W108
P2
P2
W4
AN/TPM-23 ANTENNA TEST SECTION
ANTENNA
P1
J2
STOW CONTROL
J1
P1
W6
P2
J1
ANTENNA UNIT 1
TRAVERSE DRIVE 1A3
P2
J1
ELEVATION DRIVE 1A2
TRAVERSE TEST SETUP
AN/TPM-23 ANTENNA TEST SECTION
ANTENNA
P1
J2
STOW CONTROL
J1
P1
W4
W6
P2
P1
W3
P2
P2
P2
P1
DISTRIBUTION BOX UNIT 6
J4
P1
W107
J5
P1
W108
W5
P2
J1
ANTENNA UNIT 1
TRAVERSE DRIVE 1A3
P2
J1
ELEVATION DRIVE 1A2
AR925502

Figure 3-1. Antenna unit 1, test setup

Table 3-1. Initial Control Settings

Location	Control	Position
Distribution box Unit 6	MODE toggle switch MAINT toggle switch	NORMAL OFF
Power supply Unit 5	All circuit breaker pushbutton switches	Depressed
Antenna test section (AN/TPM-23)	POT EXCITATION rotary switch AMPL ERR SIG toggle switch AMPLIFIER OUTPUT TOGGLE SWITCH	OFF OFF NO LOAD

i. Set the multimeter to measure Vdc and connect it across LIM SW and 24V RET.

j. Set AMPL ERR SIG switch to ON.

k. Set the AMPLIFIER OUTPUT switch to LOAD.

l. Observe that +24 Vdc appears across LIM SW and 24V RET. If not, align limit switch.

m. Slowly rotate EL/TRAV POS dial clockwise until multimeter indicates 0 volts. Slowly rotate EL/TRAV POS counterclockwise until multimeter again indicates 0 volts.

n. Elevation limits will occur between 96 and 121 degrees at one limit, and between 344 and 352 degrees at the other limit.

o. Traverse limits will occur between 31 and 35.5 degrees at one limit and 324.5 and 329 degrees at the other limit.

p. If limits do not fall in tolerance, align limit switch so that they do.

3-5. Antenna Unit 1 Subsystem Troubleshooting. Figure FO-5 is the functional schematic diagram you will use when troubleshooting the antenna unit 1 subsystem. The schematic has the test points designated in the fault localization diagram and the voltage or waveform measured at the test point.

3-6. System Component and Test Point Location. Figure 3-2 is the component location diagram for the distribution box unit 6. Figure 3-3 is the component and test point location diagram for the power supply unit 5, showing those components associated with this subsystem. Figure 3-4 contains the antenna unit 1 component and test point locations, while figure 3-5 identifies the connector pin locations for the connectors used in this subsystem.

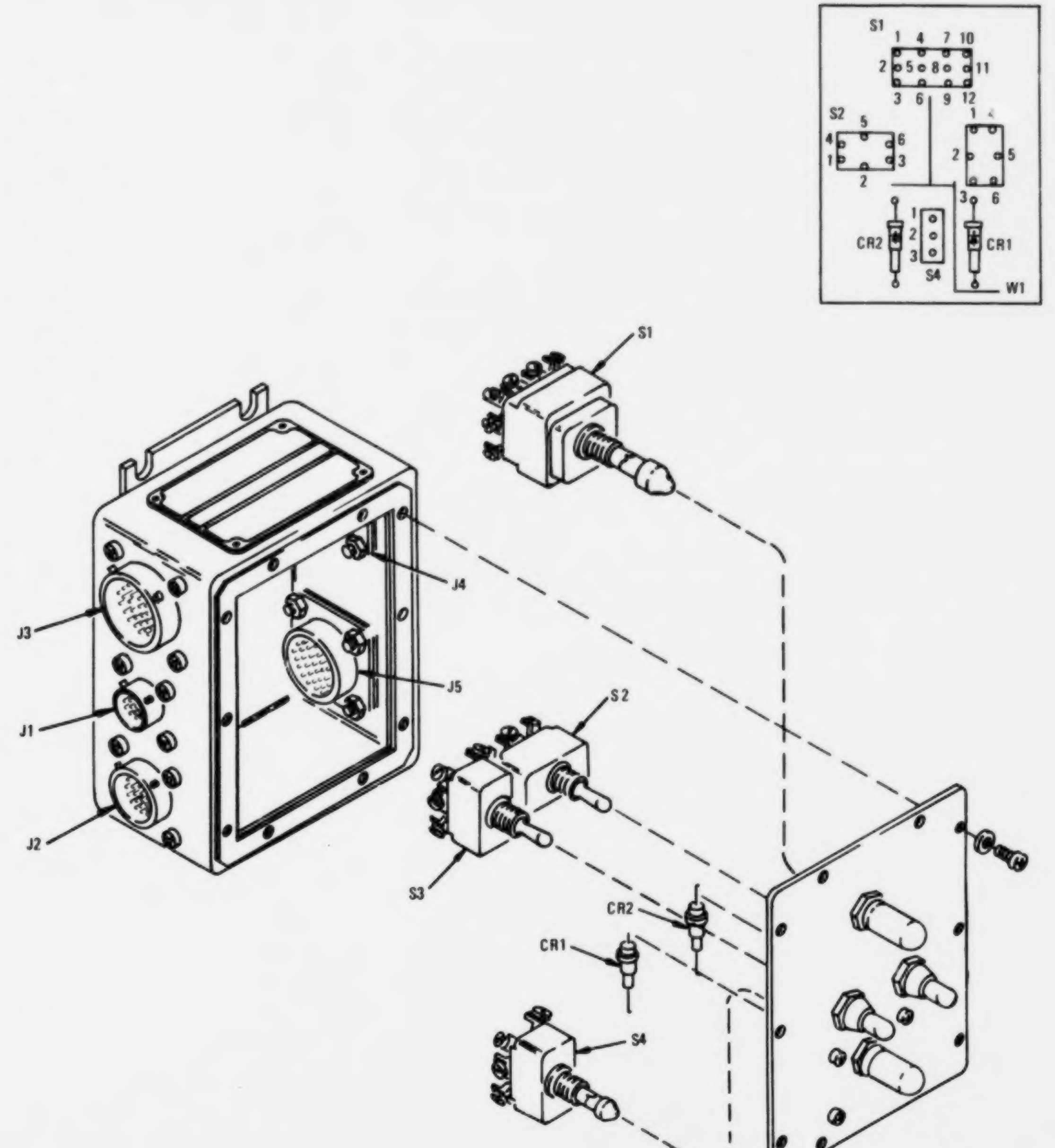

S1
1 4 7 10
2 5 8 11
3 6 9 12
S2
5
4 6
1 3
2
1 4
2 5
3 6
1
2
3
CR2
S4
CR1
W1
S1
J4
J3
J5
J1
S2
J2
S3
CR2
CR1
S4
AR925503

Figure 3-2. Distribution box unit 6, component location

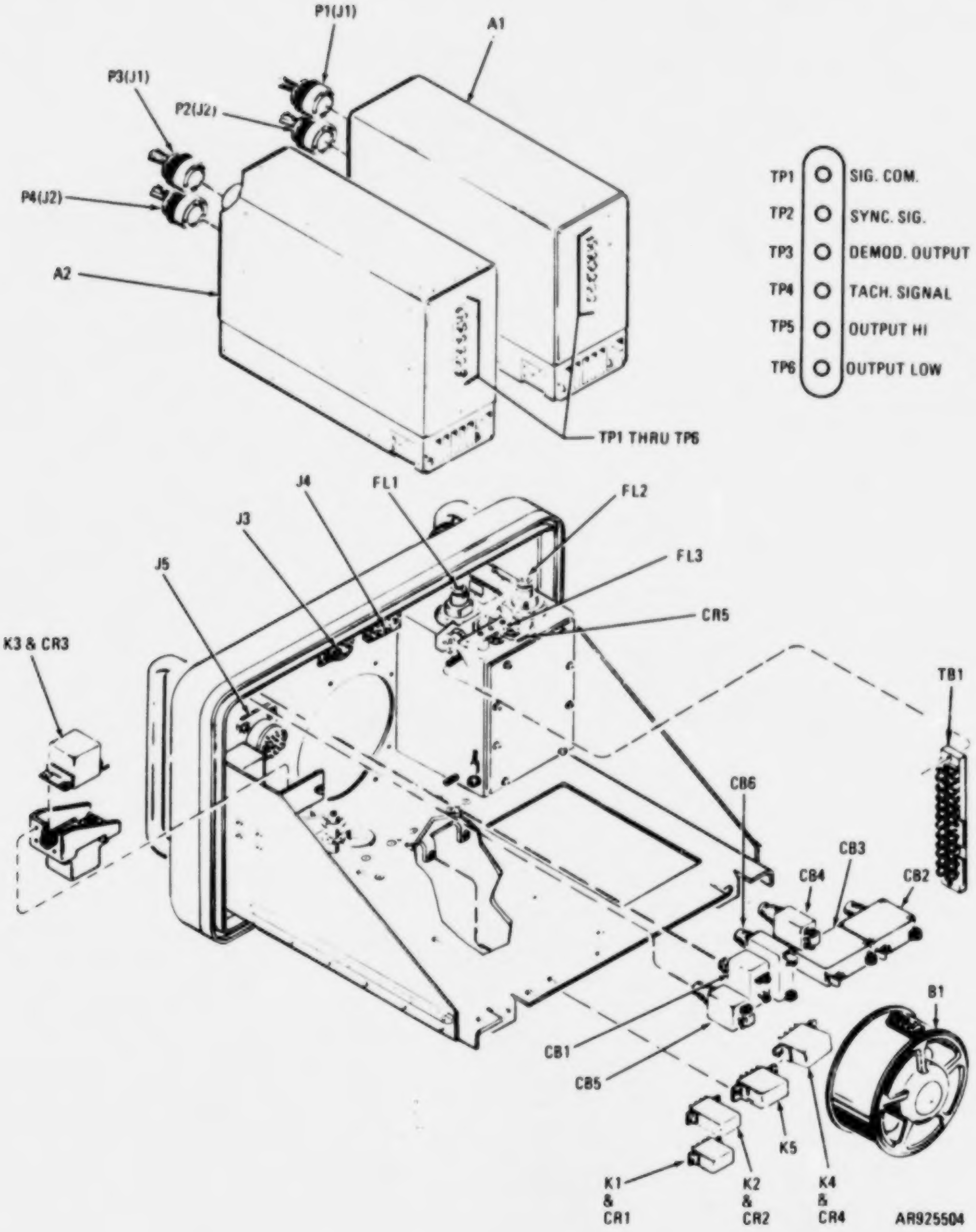

P1(J1)
A1
P3(J1)
P2(J2)
P4(J2)
A2
TP1 SIG. COM.
TP2 SYNC. SIG.
TP3 DEMOD. OUTPUT
TP4 TACH. SIGNAL
TP5 OUTPUT HI
TP6 OUTPUT LOW
TP1 THRU TP6
J4
FL1
FL2
J3
FL3
J5
CR5
K3 & CR3
TB1
CB6
CB3
CB4
CB2
B1
CB1
CB5
K5
K1 & CR1
K2 & CR2
K4 & CR4
AR925504

Figure 3-3. Power supply unit 5, component location

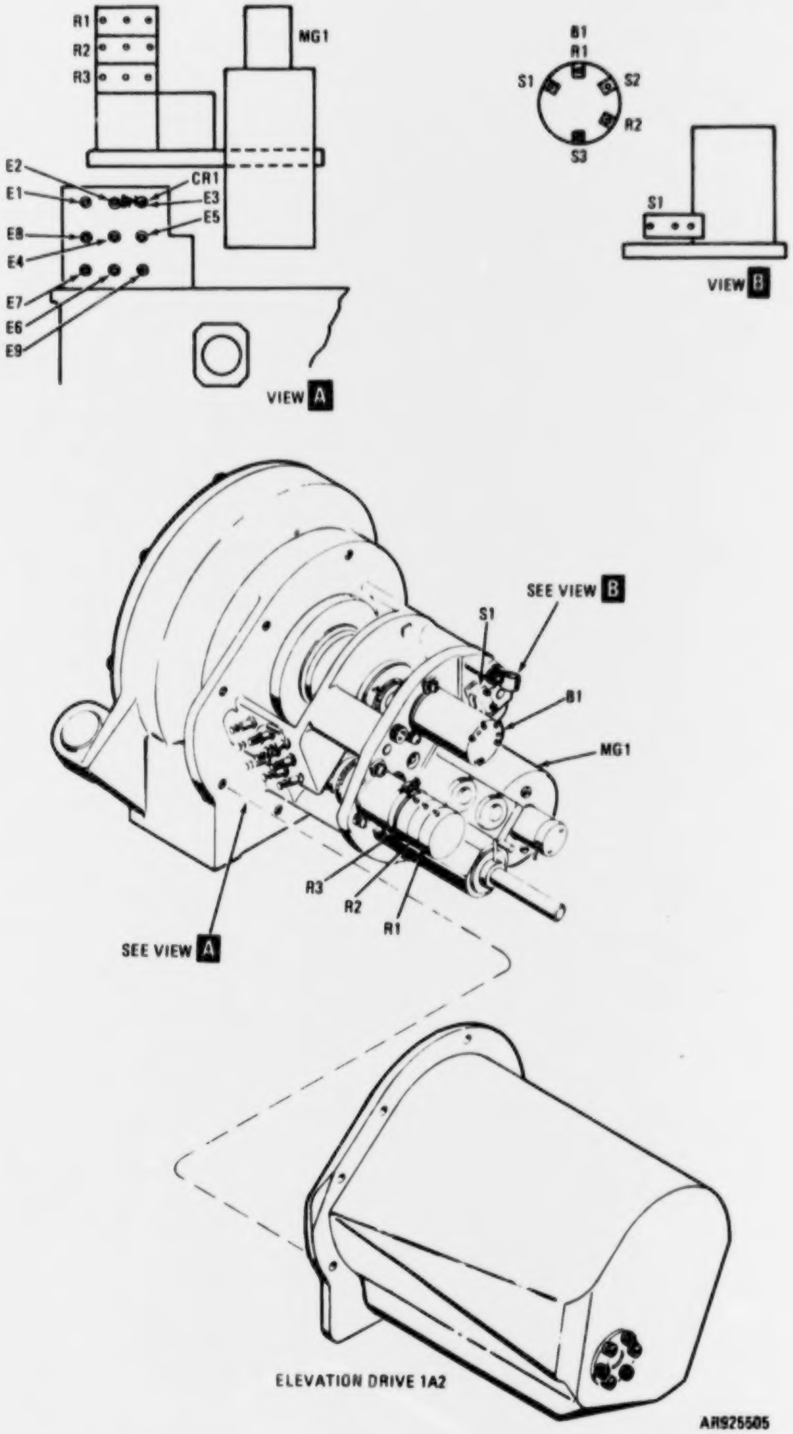

R1
R2
R3
MG1
E2
E1
CR1
E3
E5
E8
E4
E7
E6
E9
VIEW A
B1
R1
S1
S2
R2
S3
S1
VIEW B
SEE VIEW B
S1
B1
MG1
R3
R2
R1
SEE VIEW A
ELEVATION DRIVE 1A2
AR925505

Figure 3-4. Antenna unit 1, component location (sheet 1 of 2)

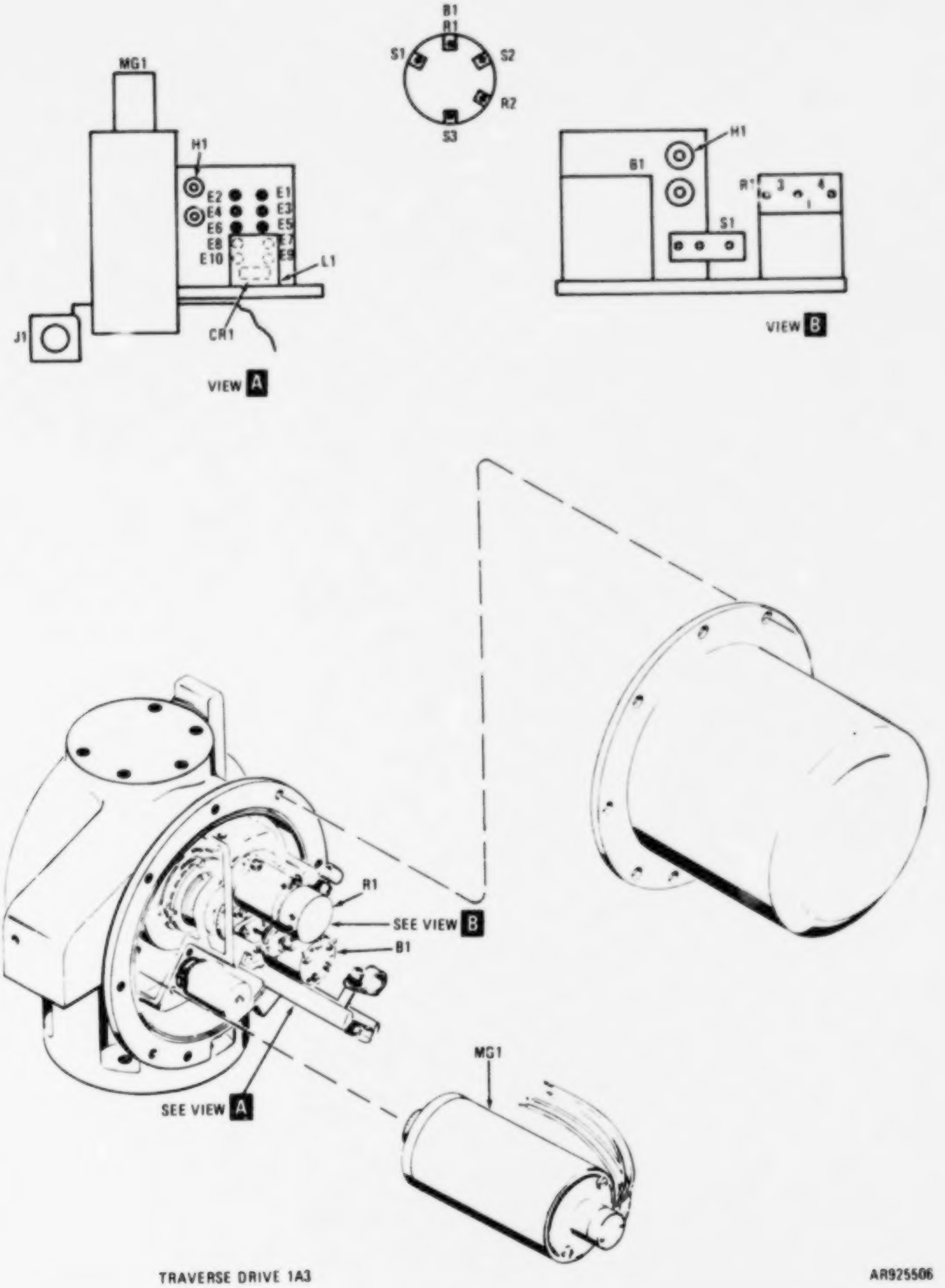
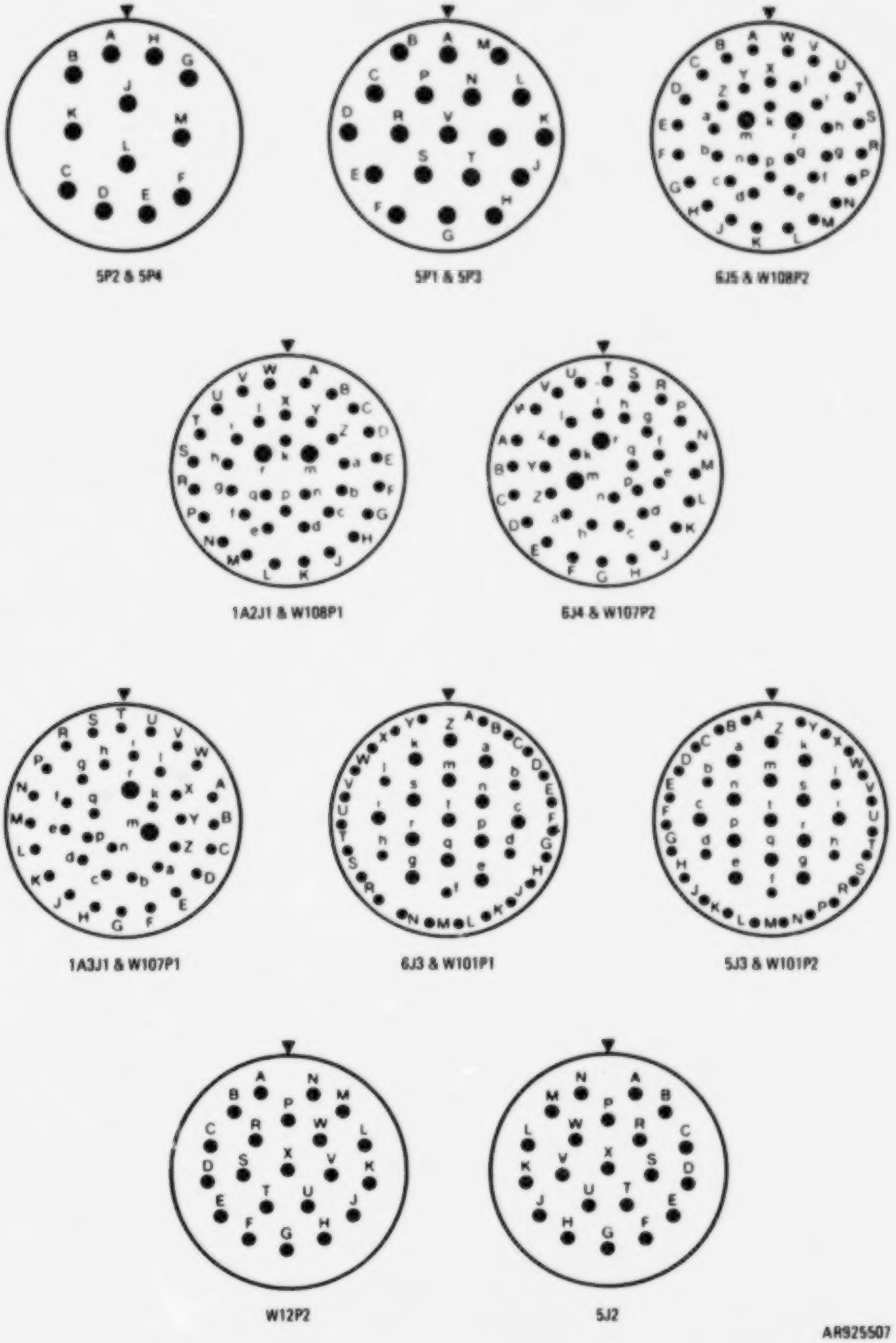

B1
R1
S1
S2
R2
S3
MG1
H1
E2
E1
E4
E3
E6
E5
E8
E7
E10
E9
L1
J1
CR1
VIEW A
H1
B1
R1
3
4
1
S1
VIEW B
R1
SEE VIEW B
B1
SEE VIEW A
MG1
TRAVERSE DRIVE 1A3
AR925506

Figure 3-4. Antenna unit 1, component location (sheet 2 of 2)



5P2 & 5P4

5P1 & 5P3

6J5 & W108P2

1A2J1 & W108P1

6J4 & W107P2

1A3J1 & W107P1

6J3 & W101P1

5J3 & W101P2

W12P2

5J2

Figure 3-5. Antenna unit 1, connector pin layout

CHAPTER 4

RECEIVER/TRANSMITTER UNIT 2 SUBSYSTEM FAULT LOCALIZATION

4-1. Receiver/Transmitter (R/T) Unit 2 Localization. This chapter contains the fault localization diagrams you will use when a failure is localized to the transmitting system as indicated in figure 2-4. Figure FO-6 is the R/T unit 2 localization diagram and is used when a radiate condition is not obtained. Figure FO-7 is used to locate the component causing loss of gated 60 MHz. Figure 4-1 is used to locate a failure in the klystron power supply 2A2. Figure 4-2 is used when a high voltage or modulator overload is obtained.

4-2. Klystron Power Supply 2A2 and Klystron Beam Power Supply 2A6 Test Procedure.

a. Set the SERV RAD CONT toggle switch to OFF, depress actuator of interlock switch, and set the SYSTEM POWER toggle switch on the FCS control panel to OFF.

b. Remove 2P18 from 2A2J1. (Refer to figure 4-4).

c. Unfasten and remove the interlock plate on the klystron power supply 2A2 as shown in figure 4-3.

d. Disconnect 2A1A3P4 from 2A2J2.

e. Disconnect 2A6P1 from 2A2J3.

f. Using the multimeter, check for continuity between cathode-filament pin 2A1A3P4-C and filament pin 2A1A3P4-B.

g. Check for an open circuit between each filament pin and grid pin 2A1A3P4-E.

h. Check for an open circuit between each of the three pins and chassis ground.

NOTE

If a klystron defect is not found, proceed with step 4-2.i. but do not reconnect 2A1A3P4; otherwise, replace the microwave chassis 2A1.

i. Connect 2A6P1 to receptacle on the interlock adapter.

j. Fasten the interlock plate to the interlock adapter.

k. Insert pins on the interlock adapter into interlock receptacle so that the ground clip engages the thumbscrew bushing.

l. Reconnect 2P18 to 2A2J1.

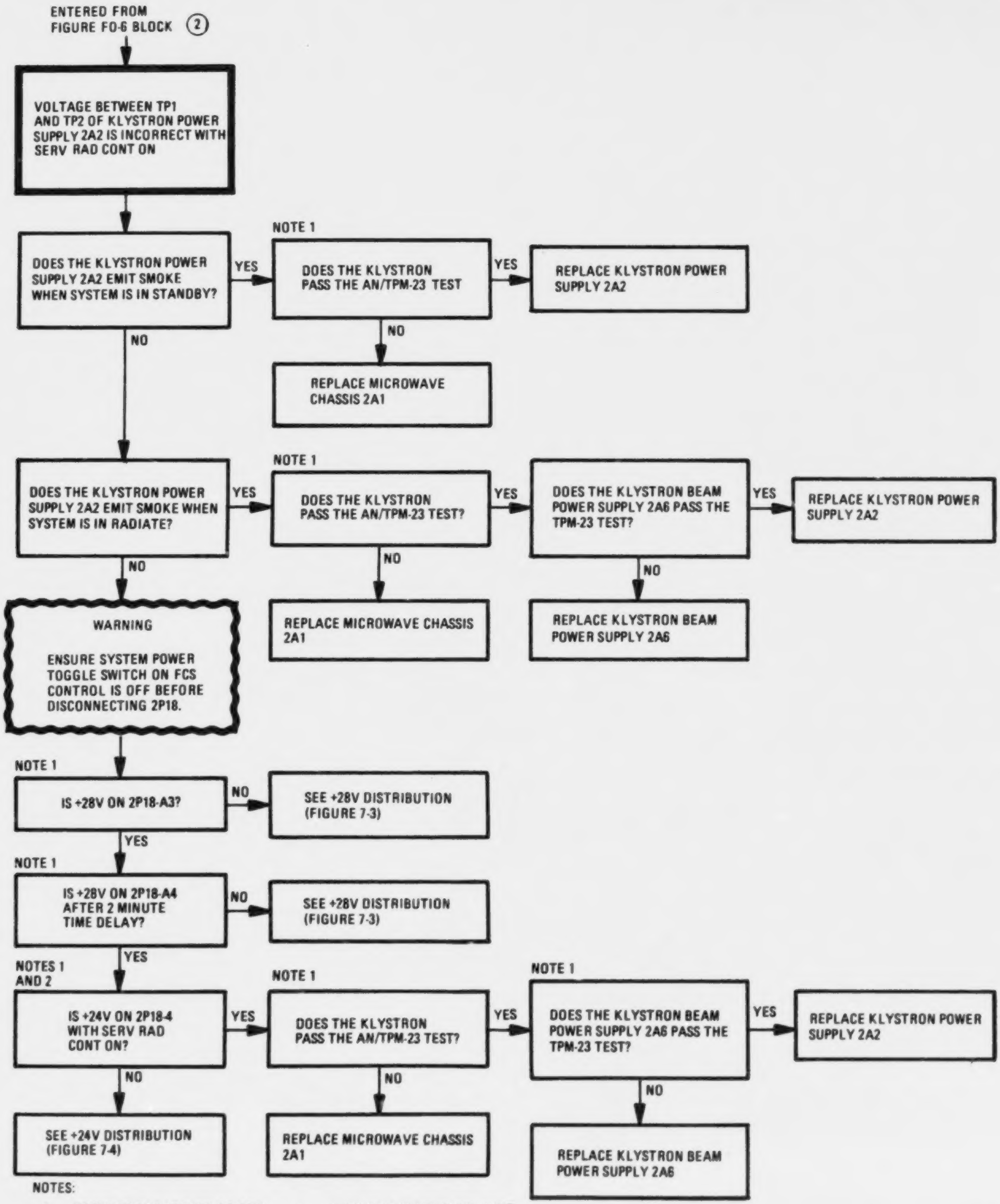
m. Set 2A1A3/2A6 toggle switch on the high voltage load section of the AN/TPM-23 to klystron beam power supply 2A6.

n. Pull the actuator of the interlock switch forward to the service position, and set the SYSTEM POWER toggle switch on the FCS control panel to ON.

o. TEST LOAD meter on high voltage load section should indicate half-scale. If not, replace klystron beam power supply 2A6.

p. Set the SERV RAD CONT toggle switch to OFF, depress the actuator of the interlock switch, and set the SYSTEM POWER toggle switch on the FCS control panel to OFF.

q. Connect W9P1 of AN/TPM-23 cable W9 to KLYSTRON jack J7 and connect W9P2 to connector 2A1A3P4.

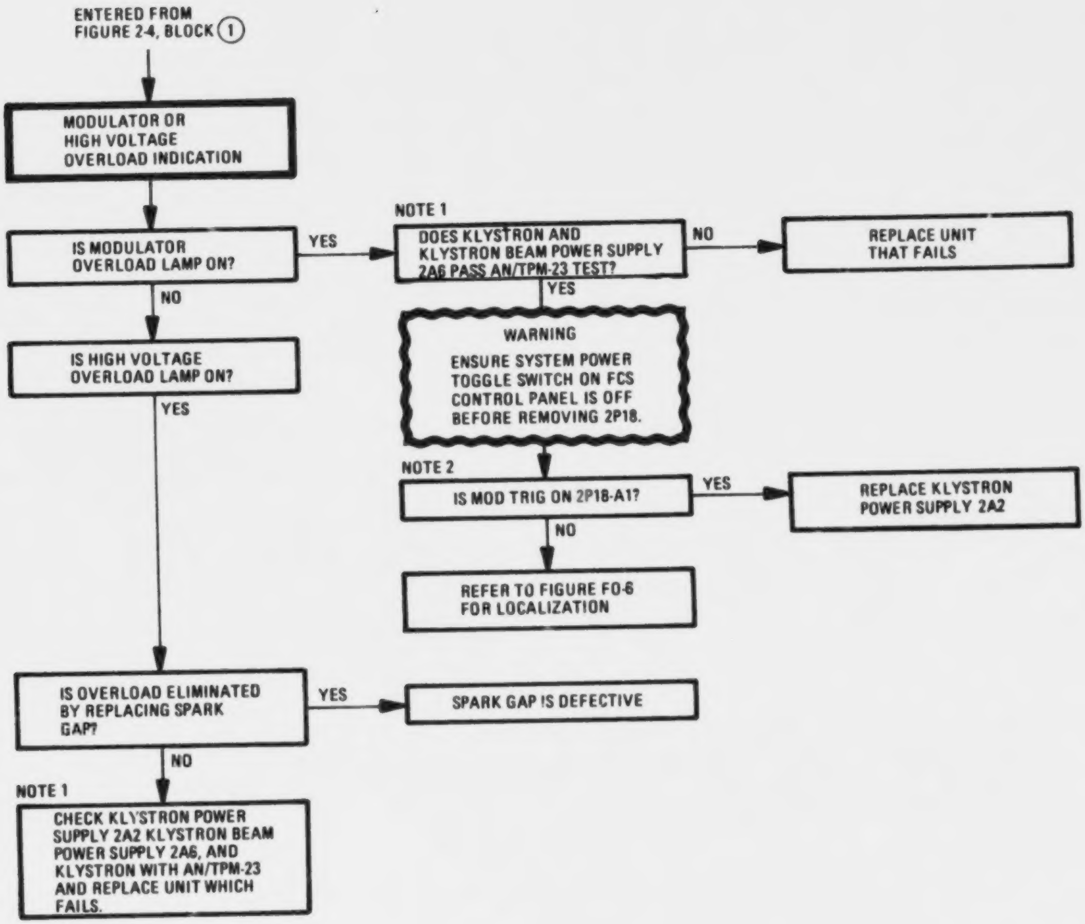

ENTERED FROM FIGURE FO-6 BLOCK ②
VOLTAGE BETWEEN TP1 AND TP2 OF KLYSTRON POWER SUPPLY 2A2 IS INCORRECT WITH SERV RAD CONT ON
DOES THE KLYSTRON POWER SUPPLY 2A2 EMIT SMOKE WHEN SYSTEM IS IN STANDBY?
YES
NOTE 1
DOES THE KLYSTRON PASS THE AN/TPM-23 TEST
YES
REPLACE KLYSTRON POWER SUPPLY 2A2
NO
REPLACE MICROWAVE CHASSIS 2A1
NO
DOES THE KLYSTRON POWER SUPPLY 2A2 EMIT SMOKE WHEN SYSTEM IS IN RADIATE?
YES
NOTE 1
DOES THE KLYSTRON PASS THE AN/TPM-23 TEST?
YES
DOES THE KLYSTRON BEAM POWER SUPPLY 2A6 PASS THE TPM-23 TEST?
YES
REPLACE KLYSTRON POWER SUPPLY 2A2
NO
REPLACE MICROWAVE CHASSIS 2A1
NO
REPLACE KLYSTRON BEAM POWER SUPPLY 2A6
NO
WARNING
ENSURE SYSTEM POWER TOGGLE SWITCH ON FCS CONTROL IS OFF BEFORE DISCONNECTING 2P18.
NOTE 1
IS +28V ON 2P18-A3?
NO
SEE +28V DISTRIBUTION (FIGURE 7-3)
YES
NOTE 1
IS +28V ON 2P18-A4 AFTER 2 MINUTE TIME DELAY?
NO
SEE +28V DISTRIBUTION (FIGURE 7-3)
YES
NOTES 1 AND 2
IS +24V ON 2P18-4 WITH SERV RAD CONT ON?
YES
NOTE 1
DOES THE KLYSTRON PASS THE AN/TPM-23 TEST?
YES
NOTE 1
DOES THE KLYSTRON BEAM POWER SUPPLY 2A6 PASS THE TPM-23 TEST?
YES
REPLACE KLYSTRON POWER SUPPLY 2A2
NO
REPLACE KLYSTRON BEAM POWER SUPPLY 2A6
NO
REPLACE MICROWAVE CHASSIS 2A1
NO
SEE +24V DISTRIBUTION (FIGURE 7-4)

NOTES:

1. REFER TO PARAGRAPH 4-2 FOR TEST PROCEDURE
2. WHEN 2P18 IS REMOVED JUMP PINS 9 AND 10

AR925508

Figure 4-1. Klystron power supply 2A2, fault localization diagram


ENTERED FROM
FIGURE 2-4, BLOCK ①
MODULATOR OR HIGH VOLTAGE OVERLOAD INDICATION
IS MODULATOR OVERLOAD LAMP ON?
YES
NOTE 1
DOES KLYSTRON AND KLYSTRON BEAM POWER SUPPLY 2A6 PASS AN/TPM-23 TEST?
NO
REPLACE UNIT THAT FAILS
NO
YES
IS HIGH VOLTAGE OVERLOAD LAMP ON?
YES
WARNING
ENSURE SYSTEM POWER TOGGLE SWITCH ON FCS CONTROL PANEL IS OFF BEFORE REMOVING 2P18.
NOTE 2
IS MOD TRIG ON 2P18-A1?
YES
REPLACE KLYSTRON POWER SUPPLY 2A2
NO
REFER TO FIGURE FO-6 FOR LOCALIZATION
IS OVERLOAD ELIMINATED BY REPLACING SPARK GAP?
YES
SPARK GAP IS DEFECTIVE
NO
NOTE 1
CHECK KLYSTRON POWER SUPPLY 2A2 KLYSTRON BEAM POWER SUPPLY 2A6, AND KLYSTRON WITH AN/TPM-23 AND REPLACE UNIT WHICH FAILS.

NOTES:

1. REFER TO PARAGRAPH 4-2 FOR TEST PROCEDURE.
2. WHEN 2P18 IS REMOVED, JUMP PINS 9 AND 10.

AR925509

Figure 4-2. High voltage or modulator overload, fault localization diagram

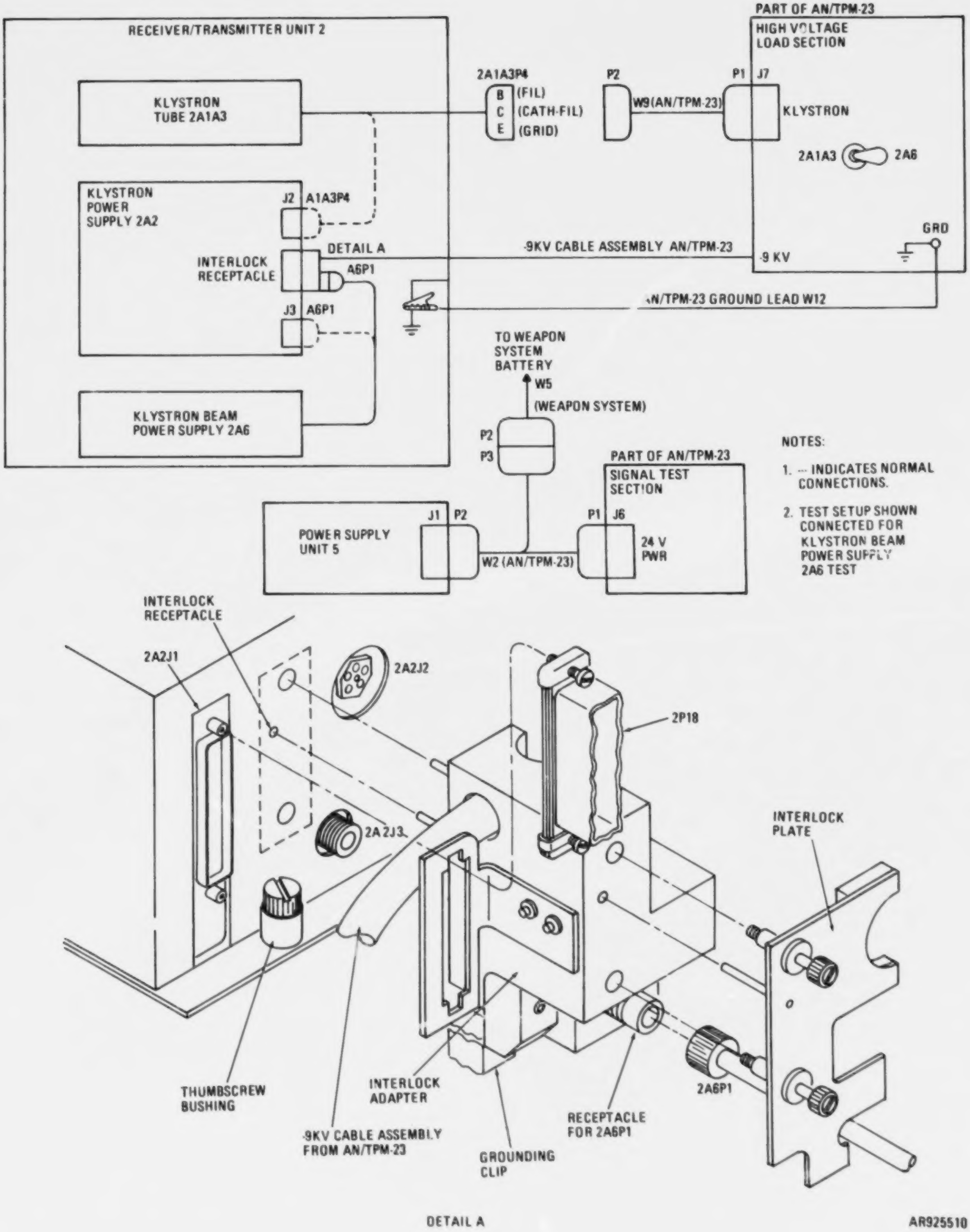

RECEIVER/TRANSMITTER UNIT 2
KLYSTRON TUBE 2A1A3
KLYSTRON POWER SUPPLY 2A2
J2
A1A3P4
INTERLOCK RECEPTACLE
DETAIL A
A6P1
J3
A6P1
KLYSTRON BEAM POWER SUPPLY 2A6
2A1A3P4
B (FIL)
C (CATH-FIL)
E (GRID)
P2
W9(AN/TPM-23)
P1
J7
PART OF AN/TPM-23
HIGH VOLTAGE LOAD SECTION
KLYSTRON
2A1A3
2A6
GRD
-9KV CABLE ASSEMBLY AN/TPM-23
-9 KV
AN/TPM-23 GROUND LEAD W12
TO WEAPON SYSTEM BATTERY
W5
(WEAPON SYSTEM)
P2
P3
PART OF AN/TPM-23
SIGNAL TEST SECTION
P1
J6
24 V PWR
POWER SUPPLY UNIT 5
J1
P2
W2 (AN/TPM-23)
NOTES:
1. --- INDICATES NORMAL CONNECTIONS.
2. TEST SETUP SHOWN CONNECTED FOR KLYSTRON BEAM POWER SUPPLY 2A6 TEST
INTERLOCK RECEPTACLE
2A2J1
2A2J2
2P18
2A2J3
INTERLOCK PLATE
THUMBSCREW BUSHING
INTERLOCK ADAPTER
-9KV CABLE ASSEMBLY FROM AN/TPM-23
GROUNDING CLIP
RECEPTACLE FOR 2A6P1
2A6P1
DETAIL A
AR925510

Figure 4-3. High voltage load, test setup

r. Set 2A1A3/2A6 switch to 2A1A3.

s. Pull the actuator of the interlock switch forward to the service position, and set the SYSTEM POWER toggle switch on the FCS control panel to ON.

t. TEST LOAD meter on high voltage load section should indicate halfscale. If not, replace microwave chassis 2A1.

u. Set the SERV RAD CONT toggle switch to OFF, depress the actuator of the interlock switch, and set the SYSTEM POWER toggle switch on the FCS control panel to OFF.

v. Disconnect W9P2 from 2A1A3P4.

w. Remove 2P18 from 2A2J1 and remove the interlock adapter.

x. Remove the interlock plate and disconnect 2A6P1 from the interlock adapter.

y. Reverse steps 4-2.b. through e. to return the R/T unit 2 to system configuration.

4-3. Klystron Tube 2A1A3 Tuning Procedure. To tune the klystron tube 2A1A3, proceed as follows:

a. With tuning tool supplied with the R/T unit 2, set the four cavities on the klystron tube 2A1A3 to the number representing the crystal installed in the X-band source.

b. Set the SYSTEM POWER toggle switch to ON. When the READY WHEN LIT lamp illuminates, set the SERV-RAD switch to ON.

c. While observing the RF POWER METER 2A1M1, detune cavity 3 to one-half of the power indication.

d. Tune cavities 1, 2, and 5 for maximum power indication.

e. Tune cavity 3 for maximum power indication.

f. Tune cavity 5 for maximum power indication.

g. Restore radar set to normal operating condition.

4-4. Transmitting Subsystem Troubleshooting. Figure FO-8 is the functional schematic diagram you use when troubleshooting the transmitting subsystem. The schematic has the test points designated in the fault location diagrams and the voltage or waveform measured at the test point.

4-5. Receiver/Transmitter Unit 2 Component and Test Point Location. Figure 4-4 is the component and test point location diagram for the receiver/transmitter unit 2. Figure 4-5 identifies connector pin locations for those connectors used in this subsystem.

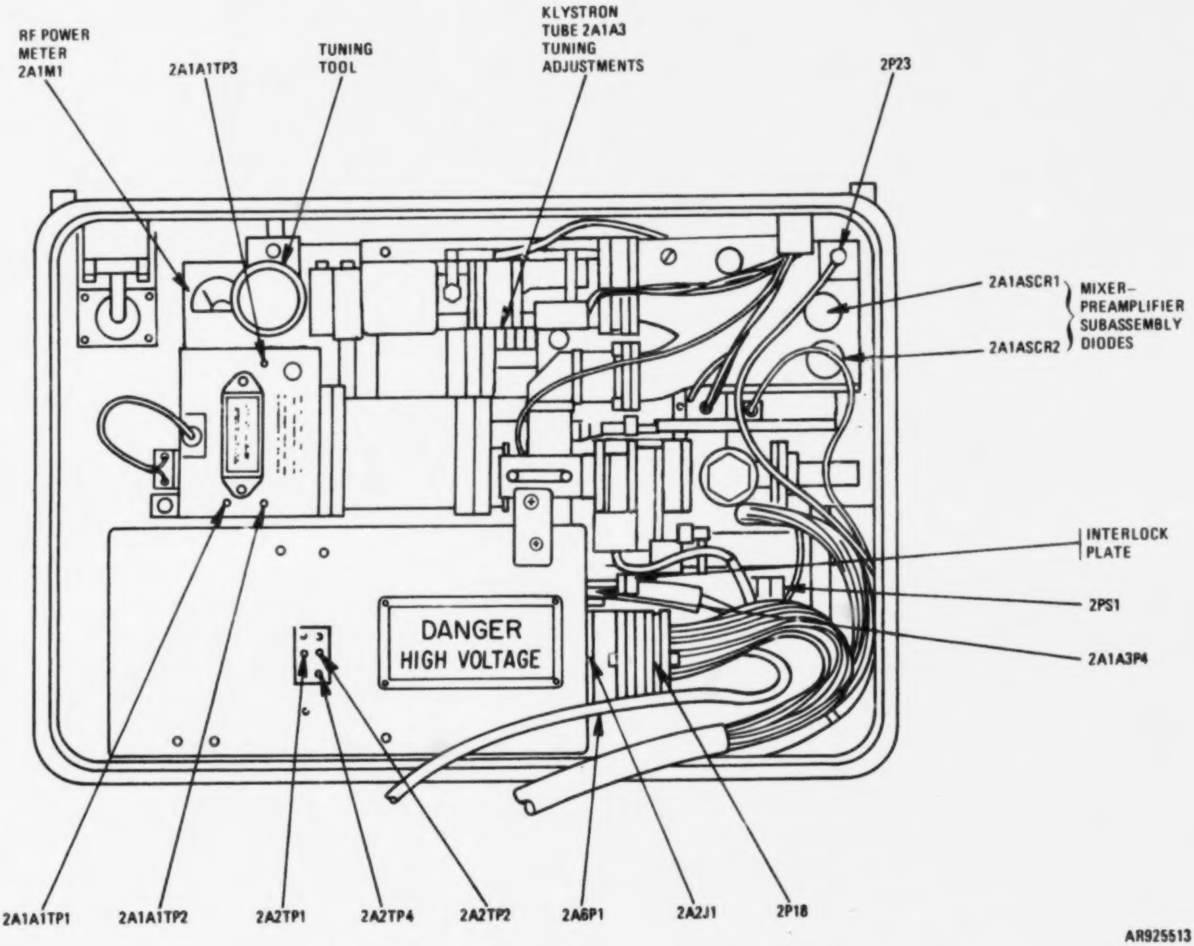

RF POWER
METER
2A1M1
2A1A1TP3
TUNING
TOOL
KLYSTRON
TUBE 2A1A3
TUNING
ADJUSTMENTS
2P23
2A1ASCR1
2A1ASCR2
MIXER-
PREAMPLIFIER
SUBASSEMBLY
DIODES
INTERLOCK
PLATE
2PS1
2A1A3P4
DANGER
HIGH VOLTAGE
2A1A1TP1
2A1A1TP2
2A2TP1
2A2TP4
2A2TP2
2A6P1
2A2J1
2P18
AR925513

Figure 4-4. Receiver/transmitter unit 2, component and test point location (sheet 1 of 3)

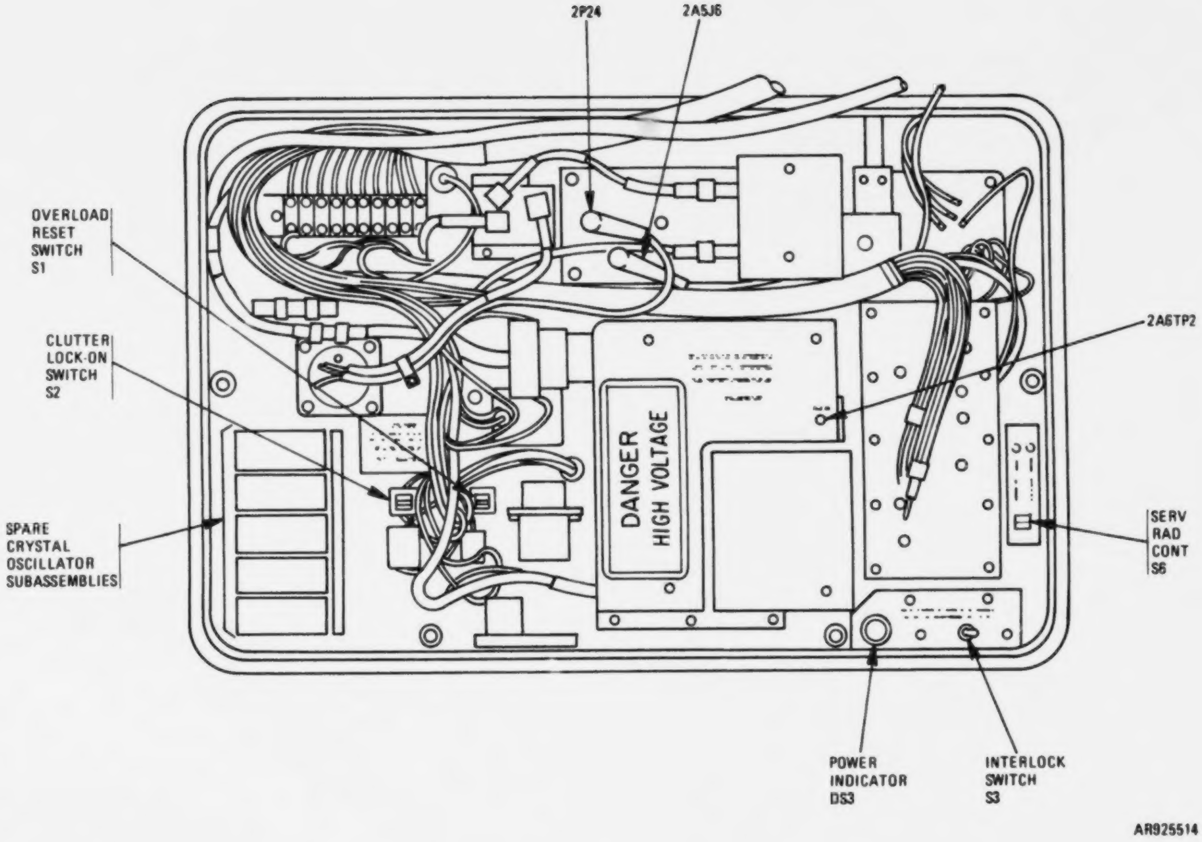
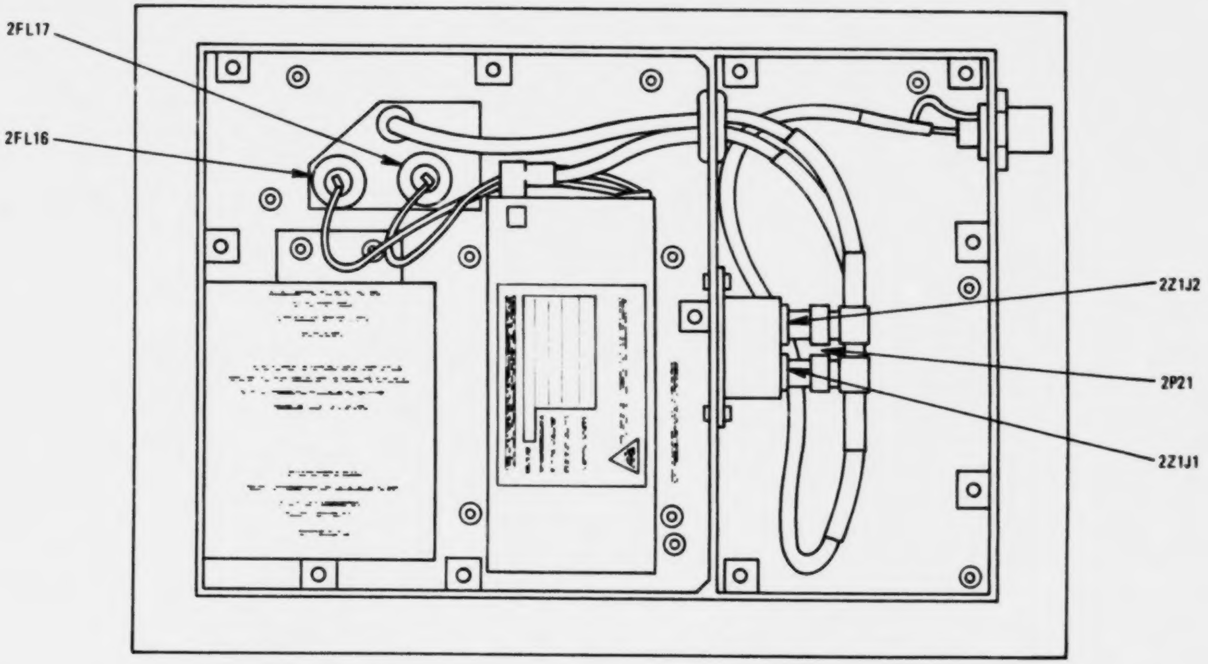

2P24
2A5J6
OVERLOAD RESET SWITCH S1
CLUTTER LOCK-ON SWITCH S2
2A6TP2
DANGER
HIGH VOLTAGE
SPARE CRYSTAL OSCILLATOR SUBASSEMBLIES
SERV RAD CONT S6
POWER INDICATOR DS3
INTERLOCK SWITCH S3
AR925514

Figure 4-4. Receiver/transmitter unit 2, component and test point location (sheet 2 of 3)


2FL17
2FL16
2Z1J2
2P21
2Z1J1

AR925515

Figure 4-4. Receiver/transmitter unit 2, component and test point location (sheet 3 of 3)

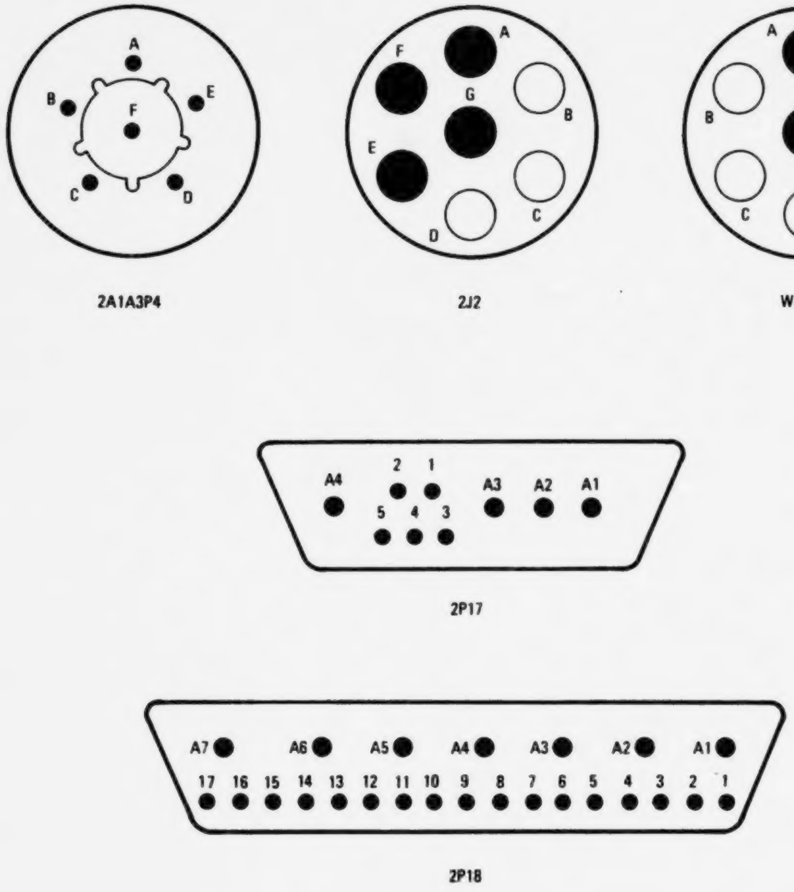

A
B
E
F
C
D
2A1A3P4
A
F
G
B
E
C
D
2J2
A
F
G
B
E
C
D
W105P4
A4
2
1
5
4
3
A3
A2
A1
2P17
A7
A6
A5
A4
A3
A2
A1
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
2P18
AR925516

Figure 4-5. Receiver/transmitter unit 2, connector pin layout

CHAPTER 5

RECEIVER UNIT 3 SUBSYSTEM FAULT LOCALIZATION

5-1. Receiver Unit 3 Fault Localization. This chapter contains the fault localization diagrams you will use when a failure is localized to the receiving system as indicated in figures 2-2 through 2-5. Figure 5-1 is the receiver unit 3 midrange calibration fault localization diagram. Figure 5-2 is the multiple gate 3A5 fault localization diagram. Figure 5-3 is the sum gate fault localization diagram. Figure 5-4 is the difference gate fault localization diagram. Figure 5-5 is the receiver unit 3 noise fault localization diagram, and figure 5-6 is the clutter lock-on fault localization diagram.

5-2. Receiver Unit 3 Troubleshooting. Figure FO-9 is the functional schematic diagram you will use when troubleshooting the receiving subsystem. The schematic has the test points designated in the fault localization diagrams and the voltage or waveform measured at the test point.

5-3. Receiver Unit 3, Component and Test Point Location. Figure 5-7 is the test point and component location diagram for the receiver unit 3. Figure 5-8 identifies connector pin locations for those connectors used in this subsystem.

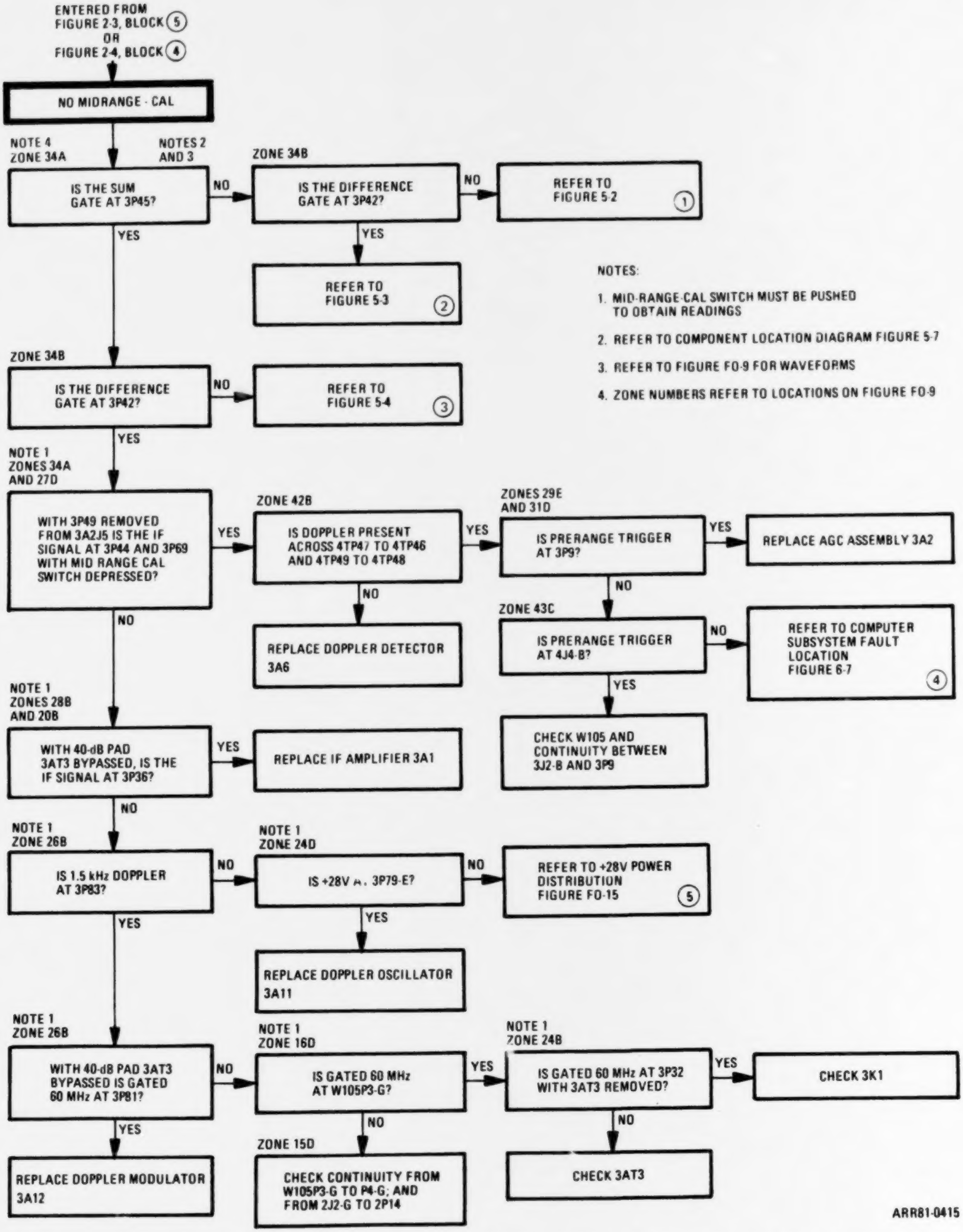

ENTERED FROM
FIGURE 2-3, BLOCK ⑤
OR
FIGURE 2-4, BLOCK ④
NO MIDRANGE - CAL
NOTE 4
ZONE 34A
NOTES 2
AND 3
IS THE SUM
GATE AT 3P45?
NO
ZONE 34B
IS THE DIFFERENCE
GATE AT 3P42?
NO
REFER TO
FIGURE 5-2 ①
YES
YES
REFER TO
FIGURE 5-3 ②
NOTES:
1. MID-RANGE-CAL SWITCH MUST BE PUSHED TO OBTAIN READINGS
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
3. REFER TO FIGURE FO-9 FOR WAVEFORMS
4. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-9
ZONE 34B
IS THE DIFFERENCE
GATE AT 3P42?
NO
REFER TO
FIGURE 5-4 ③
YES
NOTE 1
ZONES 34A
AND 27D
WITH 3P49 REMOVED
FROM 3A2J5 IS THE IF
SIGNAL AT 3P44 AND 3P69
WITH MID RANGE CAL
SWITCH DEPRESSED?
YES
ZONE 42B
IS DOPPLER PRESENT
ACROSS 4TP47 TO 4TP46
AND 4TP49 TO 4TP48
YES
ZONES 29E
AND 31D
IS PRERANGE TRIGGER
AT 3P9?
YES
REPLACE AGC ASSEMBLY 3A2
NO
REPLACE DOPPLER DETECTOR
3A6
NO
ZONE 43C
IS PRERANGE TRIGGER
AT 4J4-B?
NO
REFER TO COMPUTER
SUBSYSTEM FAULT
LOCATION
FIGURE 6-7 ④
YES
CHECK W105 AND
CONTINUITY BETWEEN
3J2-B AND 3P9
NO
NOTE 1
ZONES 28B
AND 20B
WITH 40-dB PAD
3AT3 BYPASSED, IS THE
IF SIGNAL AT 3P36?
YES
REPLACE IF AMPLIFIER 3A1
NO
NOTE 1
ZONE 26B
IS 1.5 kHz DOPPLER
AT 3P83?
NO
NOTE 1
ZONE 24D
IS +28V AT 3P79-E?
NO
REFER TO +28V POWER
DISTRIBUTION
FIGURE FO-15 ⑤
YES
REPLACE DOPPLER OSCILLATOR
3A11
YES
NOTE 1
ZONE 26B
WITH 40-dB PAD 3AT3
BYPASSED IS GATED
60 MHz AT 3P81?
NO
NOTE 1
ZONE 16D
IS GATED 60 MHz
AT W105P3-G?
YES
NOTE 1
ZONE 24B
IS GATED 60 MHz AT 3P32
WITH 3AT3 REMOVED?
YES
CHECK 3K1
YES
REPLACE DOPPLER MODULATOR
3A12
NO
ZONE 15D
CHECK CONTINUITY FROM
W105P3-G TO P4-G; AND
FROM 2J2-G TO 2P14
NO
CHECK 3AT3
ARR81-0415

Figure 5-1. Receiver unit 3 mid-range calibration, fault localization diagram

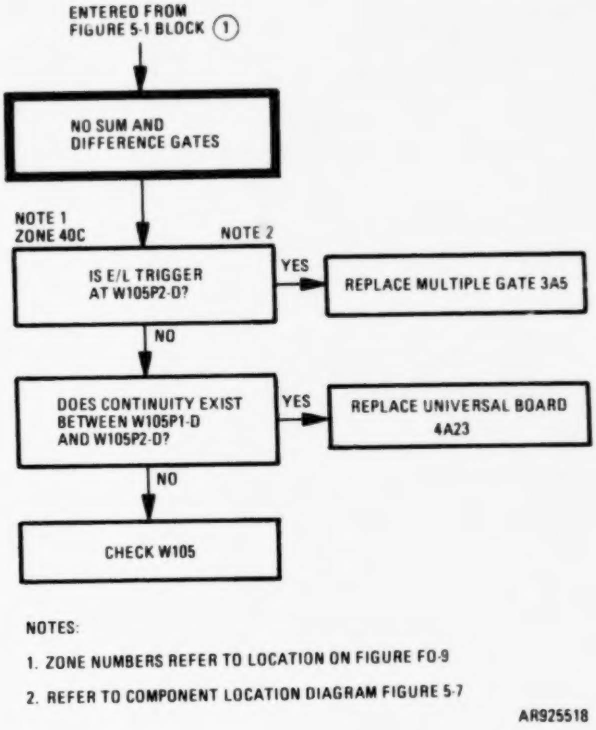
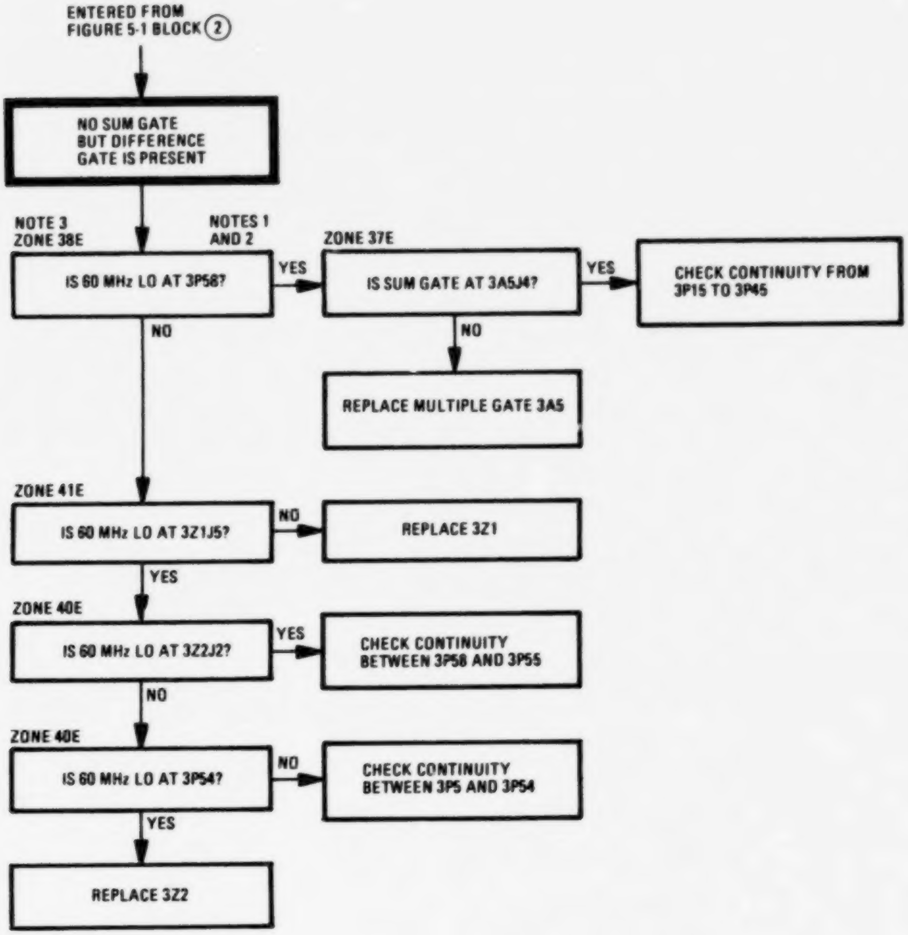

ENTERED FROM
FIGURE 5-1 BLOCK ①
NO SUM AND
DIFFERENCE GATES
NOTE 1
ZONE 40C
NOTE 2
IS E/L TRIGGER
AT W105P2-D?
YES
REPLACE MULTIPLE GATE 3A5
NO
DOES CONTINUITY EXIST
BETWEEN W105P1-D
AND W105P2-D?
YES
REPLACE UNIVERSAL BOARD
4A23
NO
CHECK W105
NOTES:
1. ZONE NUMBERS REFER TO LOCATION ON FIGURE FO-9
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
AR925518

Figure 5-2. Multiple gate 3A5, fault localization diagram

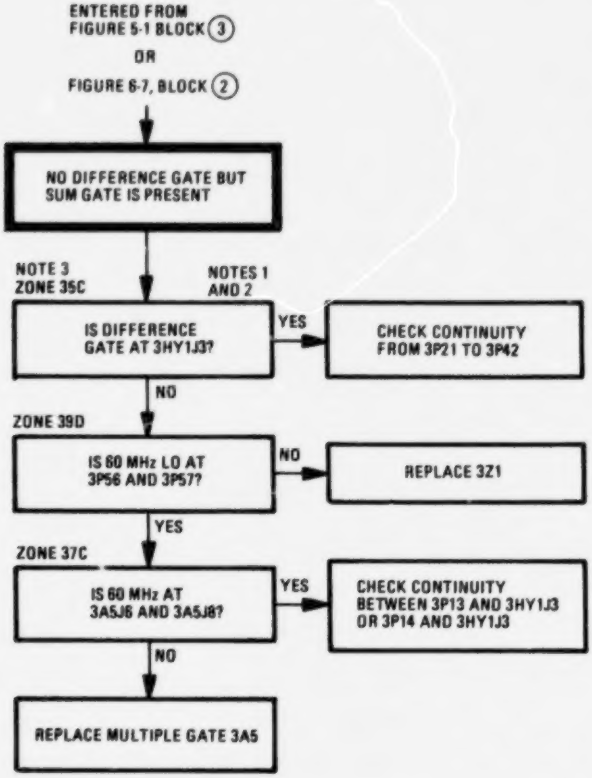

ENTERED FROM
FIGURE 5-1 BLOCK ②
NO SUM GATE BUT DIFFERENCE GATE IS PRESENT
NOTE 3
ZONE 38E
NOTES 1 AND 2
IS 60 MHz LO AT 3P58?
YES
ZONE 37E
IS SUM GATE AT 3A5J4?
YES
CHECK CONTINUITY FROM 3P15 TO 3P45
NO
REPLACE MULTIPLE GATE 3A5
NO
ZONE 41E
IS 60 MHz LO AT 3Z1J5?
NO
REPLACE 3Z1
YES
ZONE 40E
IS 60 MHz LO AT 3Z2J2?
YES
CHECK CONTINUITY BETWEEN 3P58 AND 3P55
NO
ZONE 40E
IS 60 MHz LO AT 3P54?
NO
CHECK CONTINUITY BETWEEN 3P5 AND 3P54
YES
REPLACE 3Z2

NOTES:

1. REFER TO FIGURE FO-9 FOR WAVEFORMS
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
3. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-9

AR925519

Figure 5-3. Sum gate, fault localization diagram

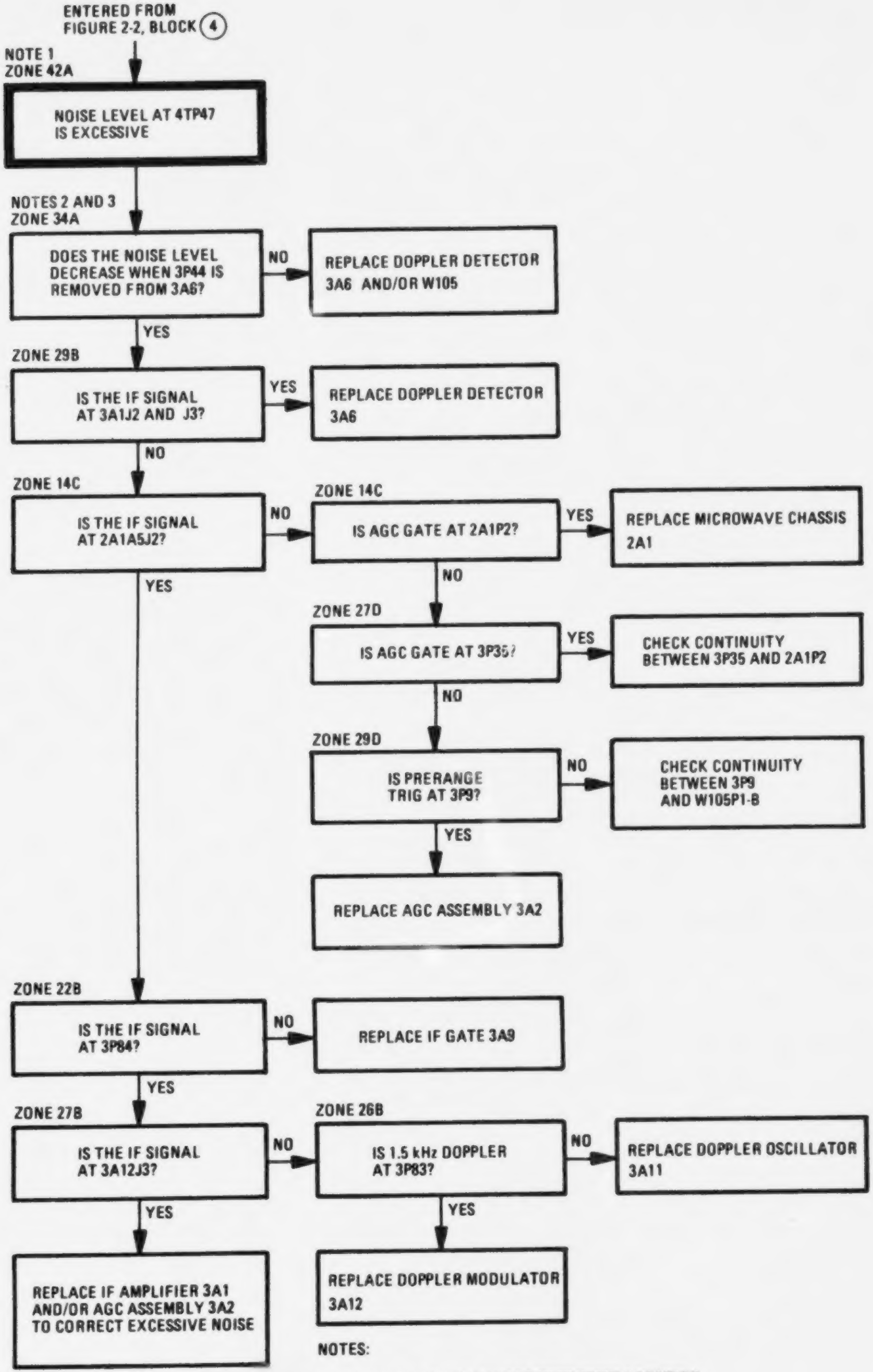

ENTERED FROM
FIGURE 5-1 BLOCK ③
OR
FIGURE 6-7, BLOCK ②
NO DIFFERENCE GATE BUT SUM GATE IS PRESENT
NOTE 3
ZONE 35C
NOTES 1 AND 2
IS DIFFERENCE GATE AT 3HY1J3?
YES
CHECK CONTINUITY FROM 3P21 TO 3P42
NO
ZONE 39D
IS 60 MHz LO AT 3P56 AND 3P57?
NO
REPLACE 3Z1
YES
ZONE 37C
IS 60 MHz AT 3A5J6 AND 3A5J8?
YES
CHECK CONTINUITY BETWEEN 3P13 AND 3HY1J3 OR 3P14 AND 3HY1J3
NO
REPLACE MULTIPLE GATE 3A5

NOTES:

1. REFER TO FIGURE FO-9 FOR WAVEFORMS
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
3. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-9

AR925520

Figure 5-4. Difference gate, fault localization diagram

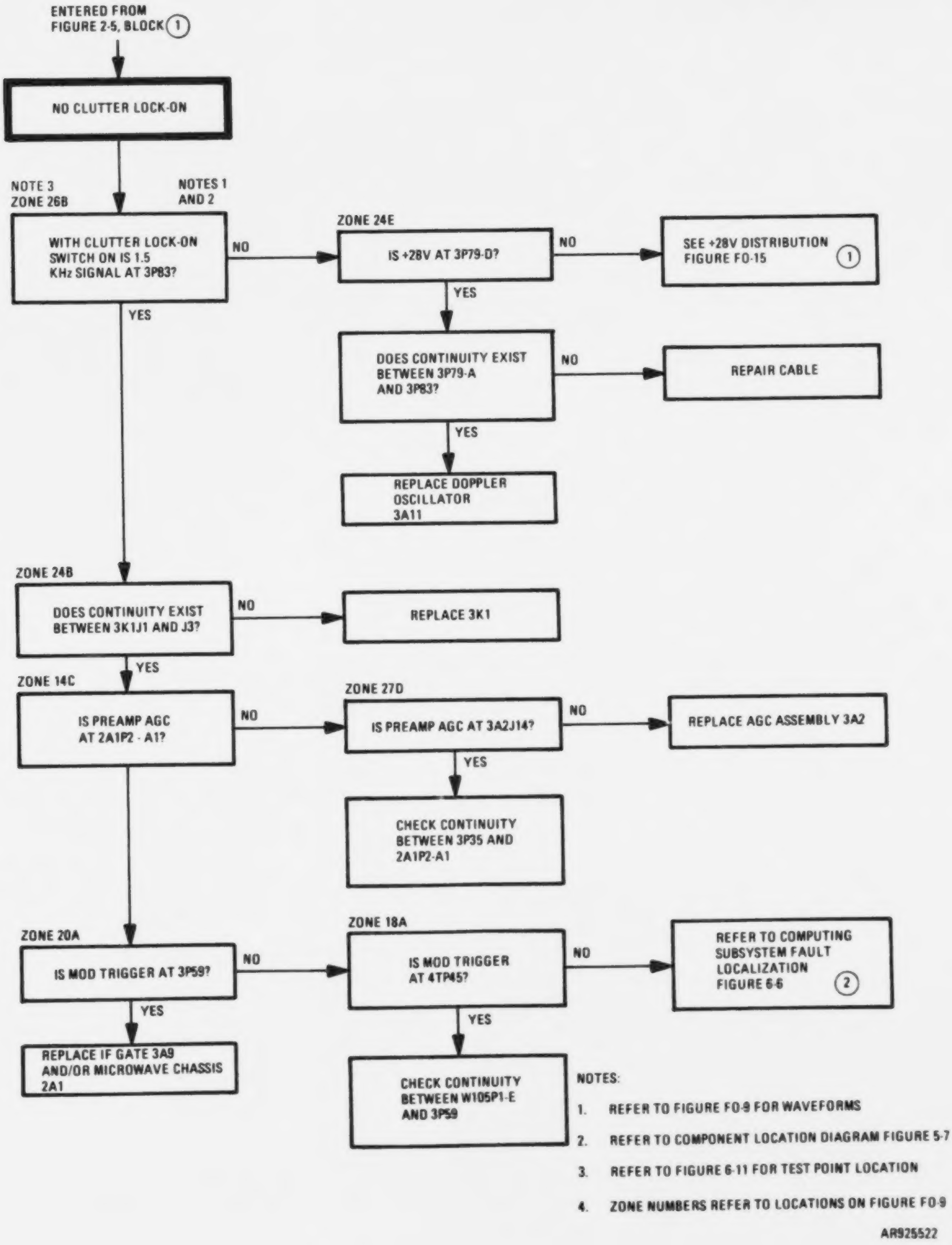

ENTERED FROM
FIGURE 2-2, BLOCK ④
NOTE 1
ZONE 42A
NOISE LEVEL AT 4TP47 IS EXCESSIVE
NOTES 2 AND 3
ZONE 34A
DOES THE NOISE LEVEL DECREASE WHEN 3P44 IS REMOVED FROM 3A6?
NO
REPLACE DOPPLER DETECTOR 3A6 AND/OR W105
YES
ZONE 29B
IS THE IF SIGNAL AT 3A1J2 AND J3?
YES
REPLACE DOPPLER DETECTOR 3A6
NO
ZONE 14C
IS THE IF SIGNAL AT 2A1A5J2?
NO
ZONE 14C
IS AGC GATE AT 2A1P2?
YES
REPLACE MICROWAVE CHASSIS 2A1
NO
ZONE 27D
IS AGC GATE AT 3P35?
YES
CHECK CONTINUITY BETWEEN 3P35 AND 2A1P2
NO
ZONE 29D
IS PRERANGE TRIG AT 3P9?
NO
CHECK CONTINUITY BETWEEN 3P9 AND W105P1-B
YES
REPLACE AGC ASSEMBLY 3A2
YES
ZONE 22B
IS THE IF SIGNAL AT 3P84?
NO
REPLACE IF GATE 3A9
YES
ZONE 27B
IS THE IF SIGNAL AT 3A12J3?
NO
ZONE 26B
IS 1.5 kHz DOPPLER AT 3P83?
NO
REPLACE DOPPLER OSCILLATOR 3A11
YES
REPLACE DOPPLER MODULATOR 3A12
YES
REPLACE IF AMPLIFIER 3A1 AND/OR AGC ASSEMBLY 3A2 TO CORRECT EXCESSIVE NOISE

NOTES:

1. REFER TO FIGURE 6-11 FOR TEST POINT LOCATION
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
3. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-9

AR925521

Figure 5-5. Receiver unit 3 noise, fault localization diagram


ENTERED FROM FIGURE 2-5, BLOCK ①
NO CLUTTER LOCK-ON
NOTE 3
ZONE 26B
NOTES 1 AND 2
WITH CLUTTER LOCK-ON SWITCH ON IS 1.5 KHz SIGNAL AT 3P83?
NO
ZONE 24E
IS +28V AT 3P79-D?
NO
SEE +28V DISTRIBUTION FIGURE FO-15 ①
YES
DOES CONTINUITY EXIST BETWEEN 3P79-A AND 3P83?
NO
REPAIR CABLE
YES
REPLACE DOPPLER OSCILLATOR 3A11
YES
ZONE 24B
DOES CONTINUITY EXIST BETWEEN 3K1J1 AND J3?
NO
REPLACE 3K1
YES
ZONE 14C
IS PREAMP AGC AT 2A1P2 - A1?
NO
ZONE 27D
IS PREAMP AGC AT 3A2J14?
NO
REPLACE AGC ASSEMBLY 3A2
YES
CHECK CONTINUITY BETWEEN 3P35 AND 2A1P2-A1
ZONE 20A
IS MOD TRIGGER AT 3P59?
NO
ZONE 18A
IS MOD TRIGGER AT 4TP45?
NO
REFER TO COMPUTING SUBSYSTEM FAULT LOCALIZATION FIGURE 6-6 ②
YES
REPLACE IF GATE 3A9 AND/OR MICROWAVE CHASSIS 2A1
YES
CHECK CONTINUITY BETWEEN W105P1-E AND 3P59
AR925522

NOTES:

1. REFER TO FIGURE FO-9 FOR WAVEFORMS
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 5-7
3. REFER TO FIGURE 6-11 FOR TEST POINT LOCATION
4. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-9

Figure 5-6. Clutter lock-on, fault localization diagram

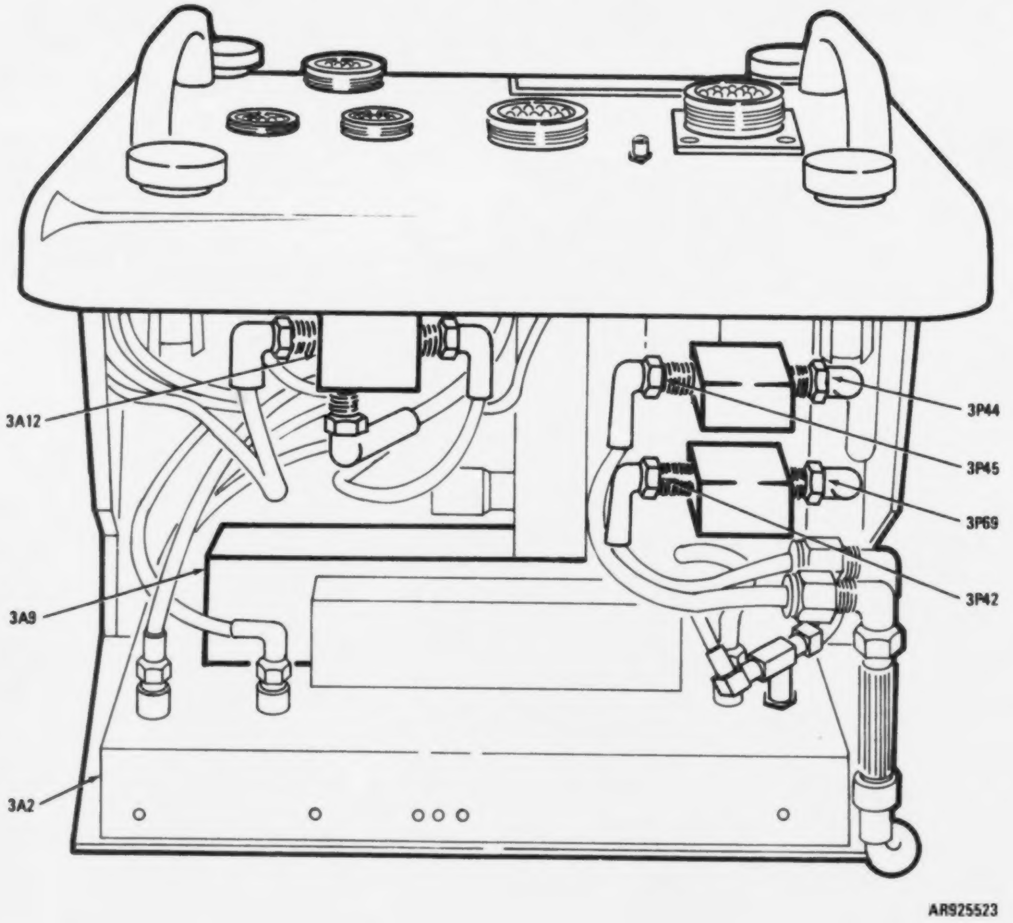

3A12
3A9
3A2
3P44
3P45
3P69
3P42
AR925523

Figure 5-7. Receiver unit 3, component and test point location (sheet 1 of 3)

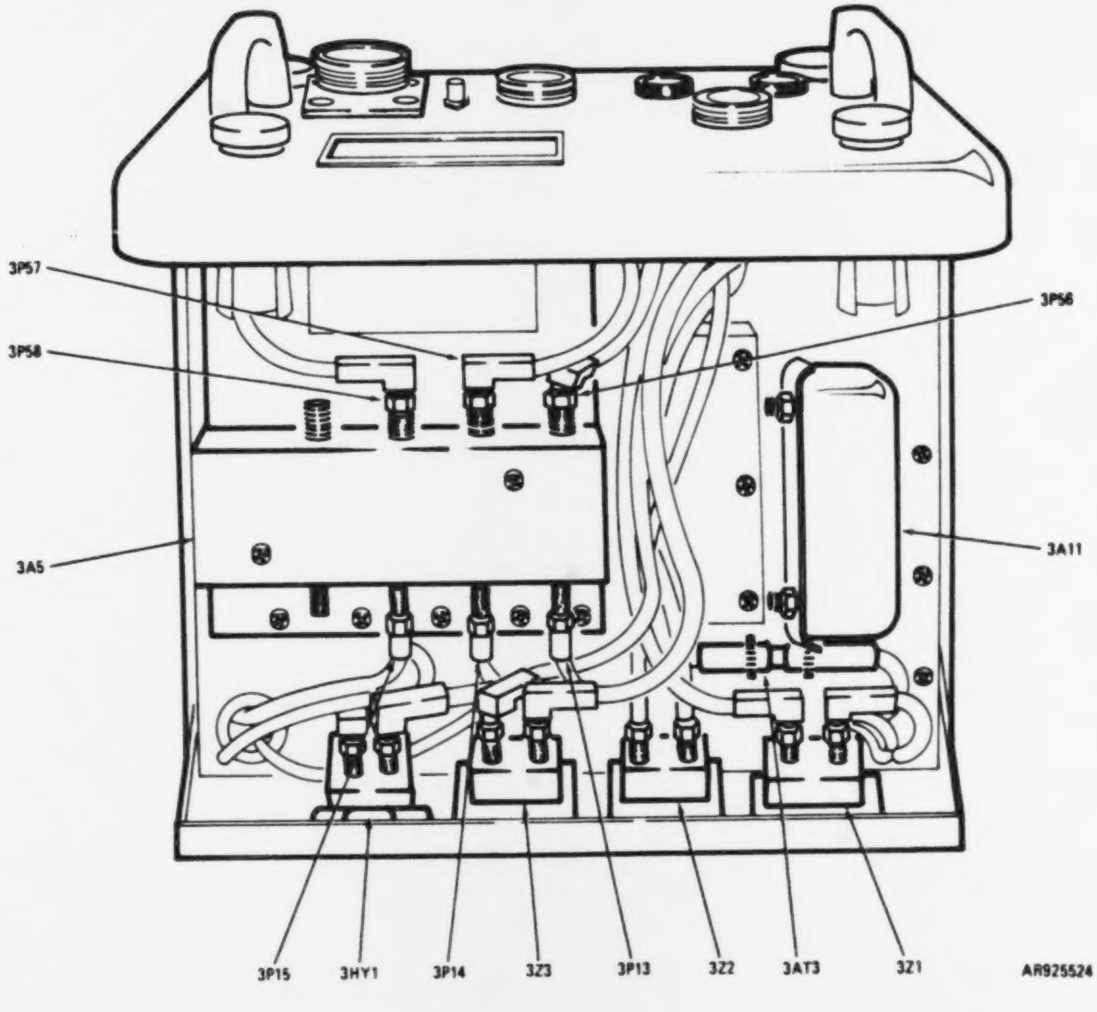

3P57
3P58
3P56
3A5
3A11
3P15
3HY1
3P14
3Z3
3P13
3Z2
3AT3
3Z1
AR925524

Figure 5-7. Receiver unit 3, component and test point location (sheet 2 of 3)

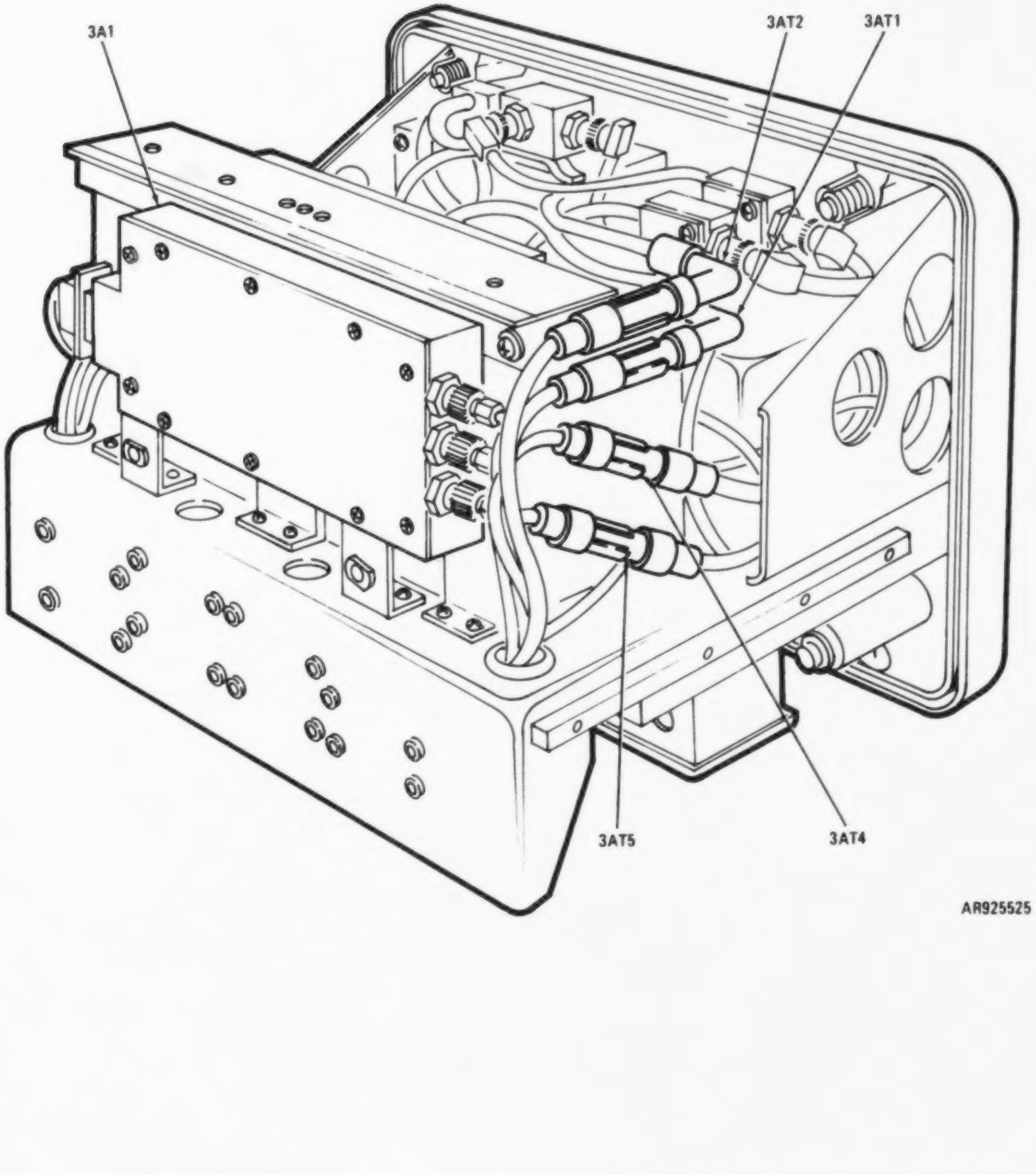

3A1
3AT2
3AT1
3AT5
3AT4
AR925525

Figure 5-7. Receiver unit 3, component and test point location (sheet 3 of 3)

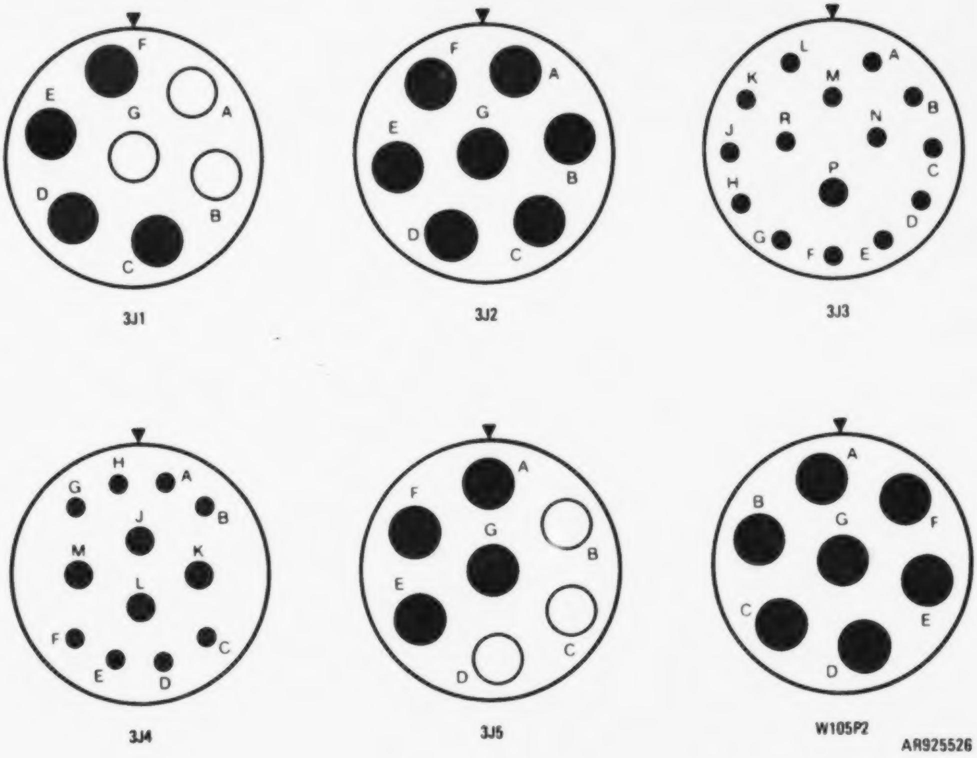

F
E
G
A
D
B
C
3J1
F
A
E
G
B
D
C
3J2
L
A
K
M
B
J
R
N
C
H
P
D
G
F
E
3J3
H
G
A
B
J
M
K
L
F
C
E
D
3J4
A
F
G
B
E
C
D
3J5
A
B
G
F
C
E
D
W105P2
AR925526

Figure 5-8. Receiver unit 3, connector pin layout

CHAPTER 6

COMPUTER UNIT 4
SUBSYSTEM FAULT LOCALIZATION

6-1. Computer Unit 4 Fault Localization.

a. This chapter contains the fault localization diagrams you will use when a failure is localized to the computing subsystem as indicated in figure 2-2, 2-3, or 2-4. Figure 6-1 is the fault localization diagram you will use when the computer is not searching. Figures 6-2 through 6-5 are continuations of the trouble analysis of faults noted in figure 6-1. Figure 6-2 locates a fault causing the loss of PRF. Figure 6-3 locates a fault causing the loss of T3/4 kHz. Figure 6-4 locates a fault causing the loss of T1. Figure 6-5 locates a fault causing the loss of the STROBE. Figure 6-6 is the fault localization diagram you will use when MOD TRIG is missing. Figure 6-7 is the fault localization diagram you will use when the computer will not go to mid-range with the button depressed. Figure 6-8 is the fault localization diagram you will use when there is no three second fade. Figure 6-9 is the fault localization diagram for locating the cause of no E/L trigger. Figure 6-10 is the fault localization diagram for locating the loss of the T1/250 pulse.

b. For a final check of the computer unit 4, check range and range rate voltages as described in paragraph 6-3.

6-2. Receiver Unit 3 Difference Channel Check. If an error is observed which appears to be caused by the difference channel, proceed as follows:

a. Check that the difference gate and the IF signal are present at the input to the difference channel.

b. Remove 3P42 and 3P45 from the balanced mixers on doppler detector 3A6.

c. Connect 3P45 (sum gate) on difference channel balanced mixer.

d. Connect 3P42 (difference gate) on sum channel balanced mixer.

e. Depress the MID-RANGE CAL button and check for doppler signal across 4TP49 and 4TP48.

f. If a doppler signal is not present, replace doppler detector 3A6.

g. If a doppler signal is present, check the phase adjustments in the receiver as described in TM 9-1285-200-30.

6-3. Range and Range Rate Outputs. To check the range and range rate voltages, proceed as follows:

a. Place the computer unit 4 MODE switch 4S2 to TEST.

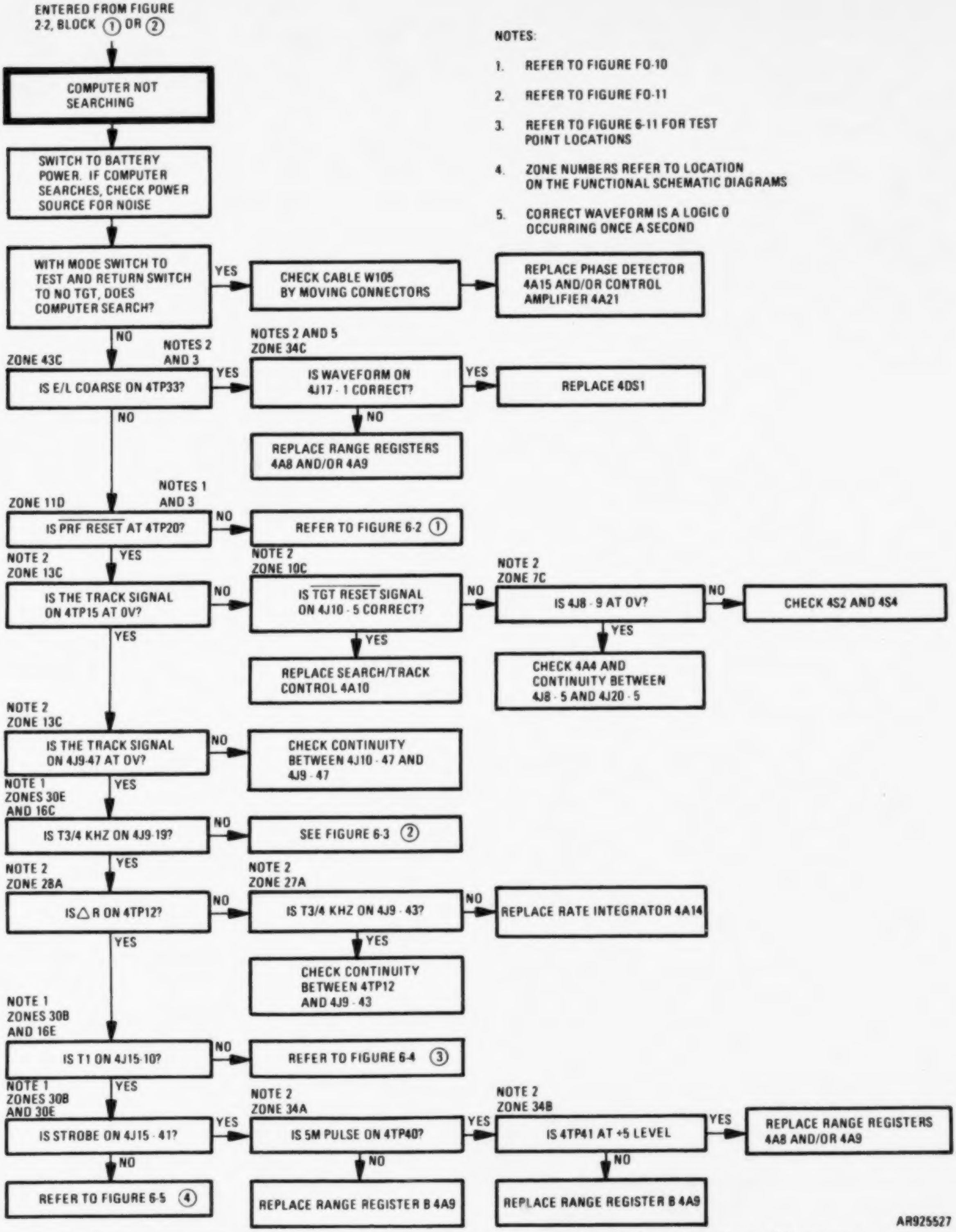
b. Place the RETURN switch 4S4 to TGT.

c. Place the ACCEL switch 4S3 to NEG.

d. Check that the range rate voltage on TP3 of range rate D/A converter 4A17 is approximately -10 Vdc. If voltage is below -9 Vdc, replace range rate D/A converter 4A17.

e. Check that the range voltage on TP3 of range D/A converter 4A16 repeatedly decreases from approximately +20 Vdc to 0 Vdc in 17 seconds. If maximum voltage is below +19 Vdc, replace range D/A converter 4A16.

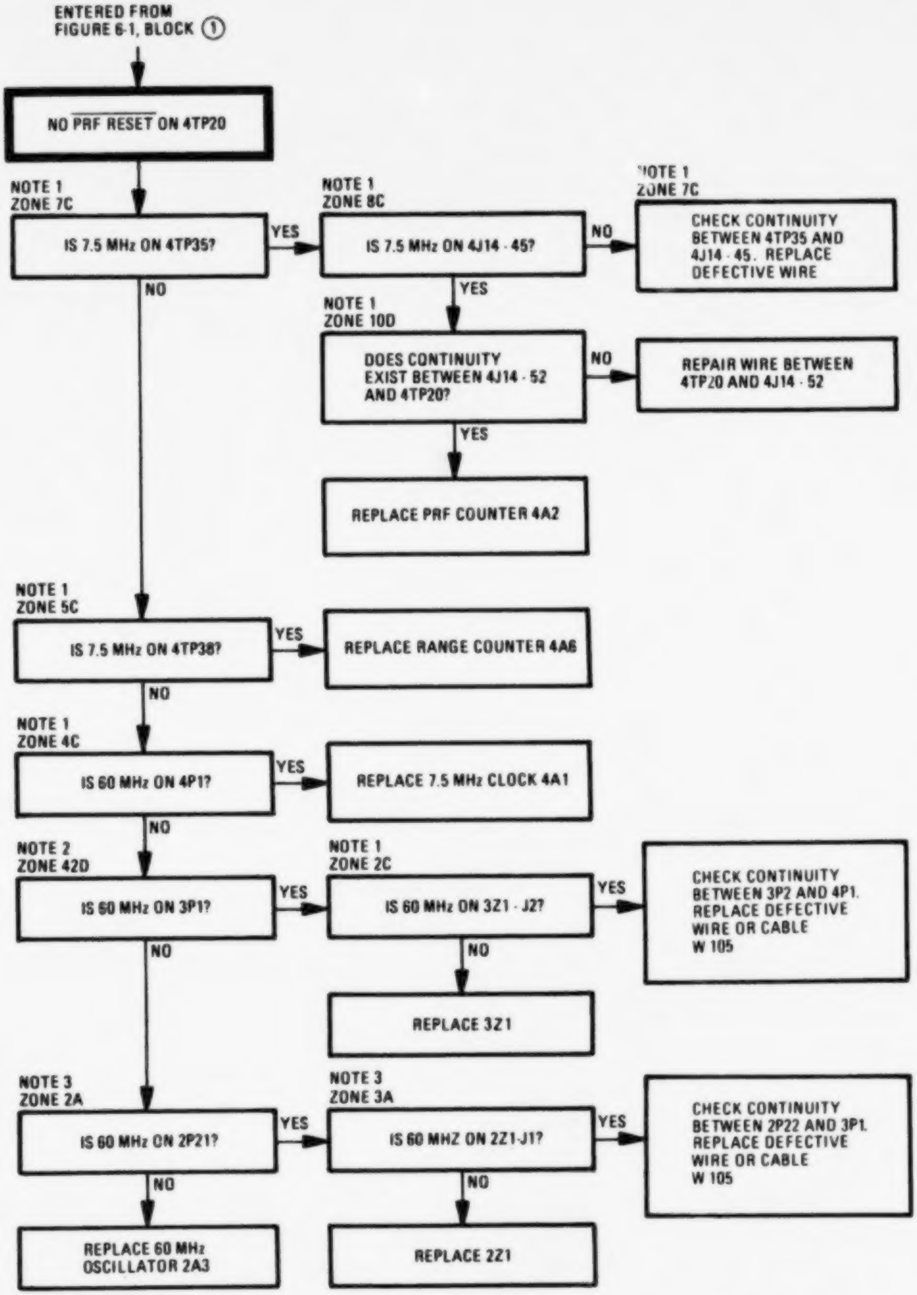
f. Place the ACCEL switch to POS.


ENTERED FROM FIGURE 2-2, BLOCK ① OR ②
COMPUTER NOT SEARCHING
SWITCH TO BATTERY POWER. IF COMPUTER SEARCHES, CHECK POWER SOURCE FOR NOISE
WITH MODE SWITCH TO TEST AND RETURN SWITCH TO NO TGT, DOES COMPUTER SEARCH?
YES
CHECK CABLE W105 BY MOVING CONNECTORS
REPLACE PHASE DETECTOR 4A15 AND/OR CONTROL AMPLIFIER 4A21
NO
ZONE 43C
NOTES 2 AND 3
IS E/L COARSE ON 4TP33?
YES
NOTES 2 AND 5
ZONE 34C
IS WAVEFORM ON 4J17 - 1 CORRECT?
YES
REPLACE 4DS1
NO
REPLACE RANGE REGISTERS 4A8 AND/OR 4A9
NO
ZONE 11D
NOTES 1 AND 3
IS $\overline{\text{PRF RESET}}$ AT 4TP20?
NO
REFER TO FIGURE 6-2 ①
YES
NOTE 2
ZONE 13C
IS THE TRACK SIGNAL ON 4TP15 AT 0V?
NO
NOTE 2
ZONE 10C
IS $\overline{\text{TGT RESET}}$ SIGNAL ON 4J10 - 5 CORRECT?
NO
NOTE 2
ZONE 7C
IS 4J8 - 9 AT 0V?
NO
CHECK 4S2 AND 4S4
YES
CHECK 4A4 AND CONTINUITY BETWEEN 4J8 - 5 AND 4J20 - 5
YES
REPLACE SEARCH/TRACK CONTROL 4A10
YES
NOTE 2
ZONE 13C
IS THE TRACK SIGNAL ON 4J9-47 AT 0V?
NO
CHECK CONTINUITY BETWEEN 4J10 - 47 AND 4J9 - 47
YES
NOTE 1
ZONES 30E AND 16C
IS T3/4 KHZ ON 4J9-19?
NO
SEE FIGURE 6-3 ②
YES
NOTE 2
ZONE 28A
IS △ R ON 4TP12?
NO
NOTE 2
ZONE 27A
IS T3/4 KHZ ON 4J9 - 43?
NO
REPLACE RATE INTEGRATOR 4A14
YES
CHECK CONTINUITY BETWEEN 4TP12 AND 4J9 - 43
YES
NOTE 1
ZONES 30B AND 16E
IS T1 ON 4J15-10?
NO
REFER TO FIGURE 6-4 ③
YES
NOTE 1
ZONES 30B AND 30E
IS STROBE ON 4J15 - 41?
YES
NOTE 2
ZONE 34A
IS 5M PULSE ON 4TP40?
YES
NOTE 2
ZONE 34B
IS 4TP41 AT +5 LEVEL
YES
REPLACE RANGE REGISTERS 4A8 AND/OR 4A9
NO
REPLACE RANGE REGISTER B 4A9
NO
REPLACE RANGE REGISTER B 4A9
NO
REFER TO FIGURE 6-5 ④
AR925527

NOTES:

1. REFER TO FIGURE FO-10
2. REFER TO FIGURE FO-11
3. REFER TO FIGURE 6-11 FOR TEST POINT LOCATIONS
4. ZONE NUMBERS REFER TO LOCATION ON THE FUNCTIONAL SCHEMATIC DIAGRAMS
5. CORRECT WAVEFORM IS A LOGIC 0 OCCURRING ONCE A SECOND

Figure 6-1. Computer unit 4 not searching, fault localization diagram

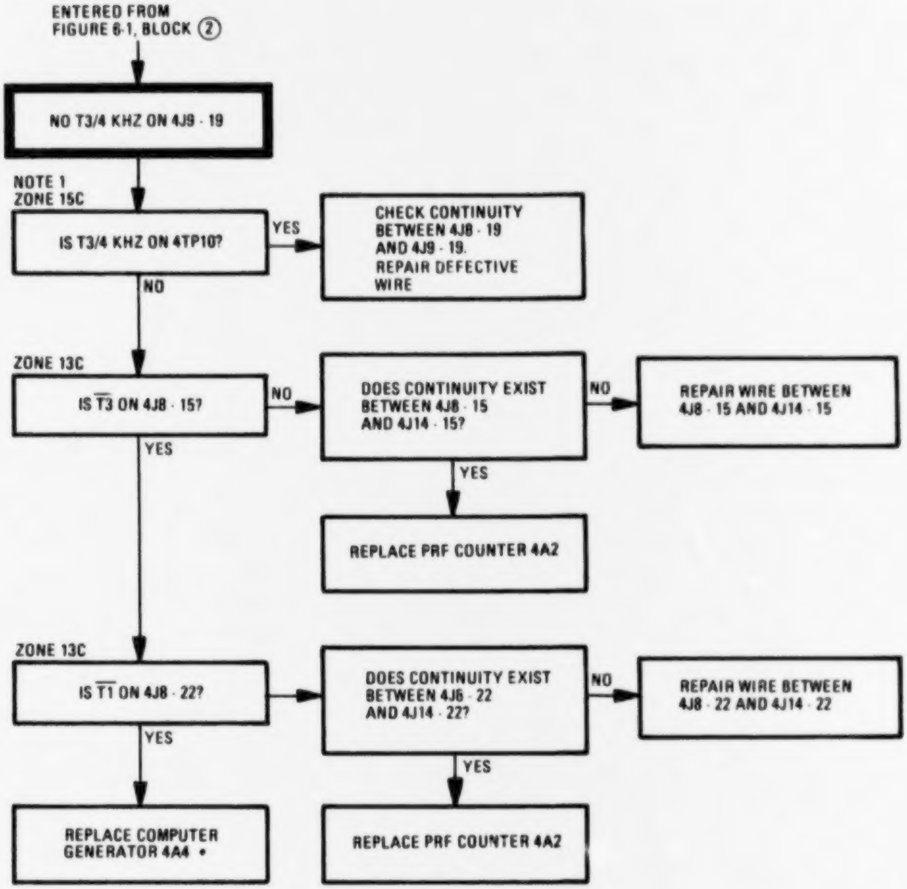

ENTERED FROM
FIGURE 6-1, BLOCK ①
NO PRF RESET ON 4TP20
NOTE 1
ZONE 7C
IS 7.5 MHz ON 4TP35?
YES
NOTE 1
ZONE 8C
IS 7.5 MHz ON 4J14 - 45?
NO
NOTE 1
ZONE 7C
CHECK CONTINUITY BETWEEN 4TP35 AND 4J14 - 45. REPLACE DEFECTIVE WIRE
YES
NOTE 1
ZONE 10D
DOES CONTINUITY EXIST BETWEEN 4J14 - 52 AND 4TP20?
NO
REPAIR WIRE BETWEEN 4TP20 AND 4J14 - 52
YES
REPLACE PRF COUNTER 4A2
NO
NOTE 1
ZONE 5C
IS 7.5 MHz ON 4TP38?
YES
REPLACE RANGE COUNTER 4A6
NO
NOTE 1
ZONE 4C
IS 60 MHz ON 4P1?
YES
REPLACE 7.5 MHz CLOCK 4A1
NO
NOTE 2
ZONE 42D
IS 60 MHz ON 3P1?
YES
NOTE 1
ZONE 2C
IS 60 MHz ON 3Z1 - J2?
YES
CHECK CONTINUITY BETWEEN 3P2 AND 4P1. REPLACE DEFECTIVE WIRE OR CABLE W 105
NO
REPLACE 3Z1
NO
NOTE 3
ZONE 2A
IS 60 MHz ON 2P21?
YES
NOTE 3
ZONE 3A
IS 60 MHZ ON 2Z1-J1?
YES
CHECK CONTINUITY BETWEEN 2P22 AND 3P1. REPLACE DEFECTIVE WIRE OR CABLE W 105
NO
REPLACE 60 MHz OSCILLATOR 2A3
NO
REPLACE 2Z1

NOTES:

1. REFER TO FIGURE FO-10
2. REFER TO FIGURE FO-9
3. REFER TO FIGURE FO-8

AR925528

Figure 6-2. PRF loss, fault localization diagram


ENTERED FROM
FIGURE 6-1, BLOCK ②
NO T3/4 KHZ ON 4J9 - 19
NOTE 1
ZONE 15C
IS T3/4 KHZ ON 4TP10?
YES
CHECK CONTINUITY BETWEEN 4J8 - 19 AND 4J9 - 19. REPAIR DEFECTIVE WIRE
NO
ZONE 13C
IS $\overline{T3}$ ON 4J8 - 15?
NO
DOES CONTINUITY EXIST BETWEEN 4J8 - 15 AND 4J14 - 15?
NO
REPAIR WIRE BETWEEN 4J8 - 15 AND 4J14 - 15
YES
REPLACE PRF COUNTER 4A2
YES
ZONE 13C
IS $\overline{T1}$ ON 4J8 - 22?
DOES CONTINUITY EXIST BETWEEN 4J6 - 22 AND 4J14 - 22?
NO
REPAIR WIRE BETWEEN 4J8 - 22 AND 4J14 - 22
YES
REPLACE PRF COUNTER 4A2
YES
REPLACE COMPUTER GENERATOR 4A4 •

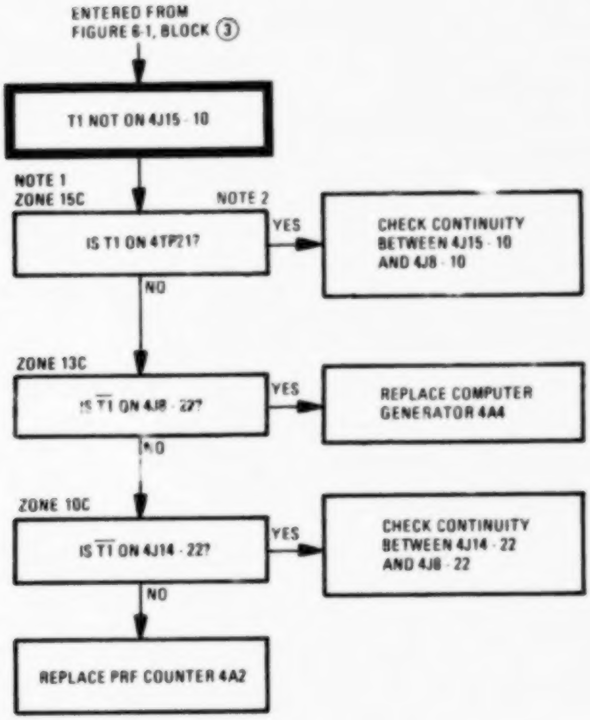
NOTES:

1. REFER TO FIGURE 6-11

2. ZONE DESIGNATIONS REFER TO LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10

AR925529

Figure 6-3. T3/4 kHz loss, fault localization diagram

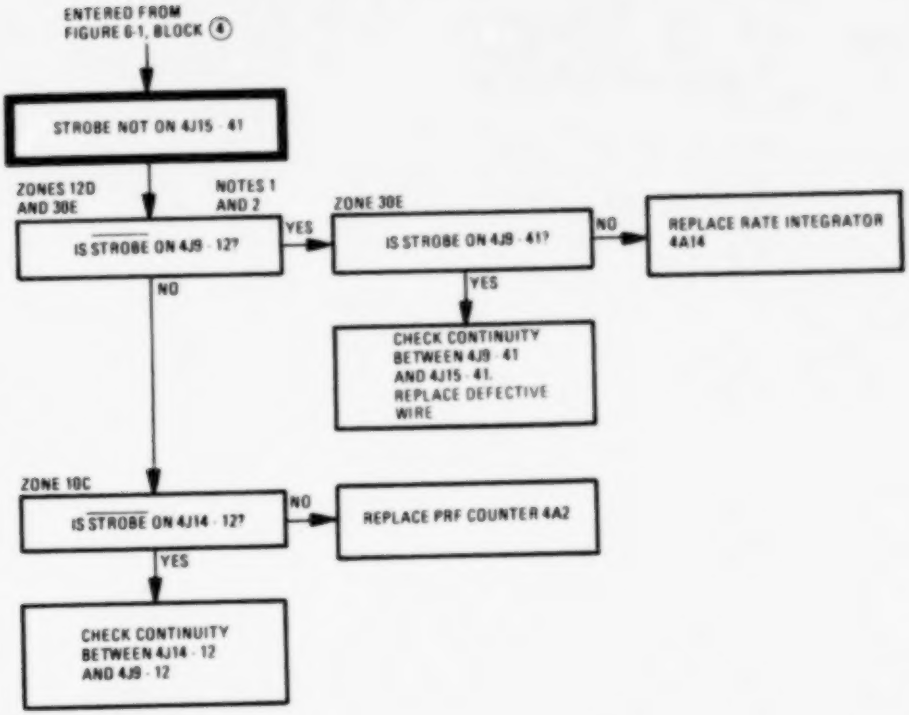

ENTERED FROM FIGURE 6-1, BLOCK ③
T1 NOT ON 4J15 - 10
NOTE 1
ZONE 15C
NOTE 2
IS T1 ON 4TP21?
YES
CHECK CONTINUITY BETWEEN 4J15 - 10 AND 4J8 - 10
NO
ZONE 13C
IS $\overline{T1}$ ON 4J8 - 22?
YES
REPLACE COMPUTER GENERATOR 4A4
NO
ZONE 10C
IS $\overline{T1}$ ON 4J14 - 22?
YES
CHECK CONTINUITY BETWEEN 4J14 - 22 AND 4J8 - 22
NO
REPLACE PRF COUNTER 4A2

NOTES:

1. REFER TO FIGURE FO-10
2. ZONE DESIGNATIONS REFER TO LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10

AR925530

Figure 6-4. T1 loss, fault localization diagram

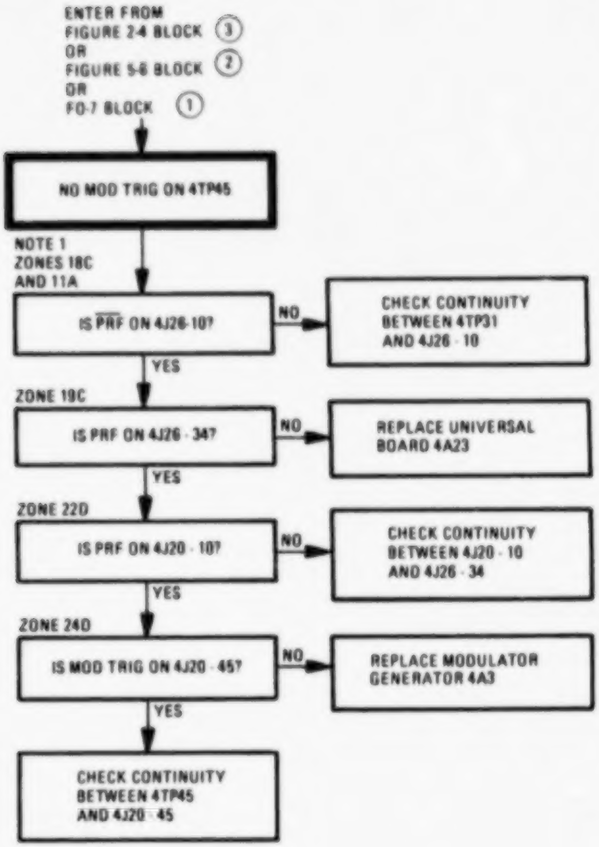

ENTERED FROM
FIGURE 6-1, BLOCK ④
STROBE NOT ON 4J15 - 41
ZONES 12D AND 30E
NOTES 1 AND 2
IS $\overline{\text{STROBE}}$ ON 4J9 - 12?
YES
ZONE 30E
IS STROBE ON 4J9 - 41?
NO
REPLACE RATE INTEGRATOR 4A14
YES
CHECK CONTINUITY BETWEEN 4J9 - 41 AND 4J15 - 41. REPLACE DEFECTIVE WIRE
NO
ZONE 10C
IS $\overline{\text{STROBE}}$ ON 4J14 - 12?
NO
REPLACE PRF COUNTER 4A2
YES
CHECK CONTINUITY BETWEEN 4J14 - 12 AND 4J9 - 12

NOTES:

1. REFER TO FIGURE FO-10
2. ZONE DESIGNATIONS REFER TO LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10

AR925531

Figure 6-5. STROBE loss, fault localization diagram

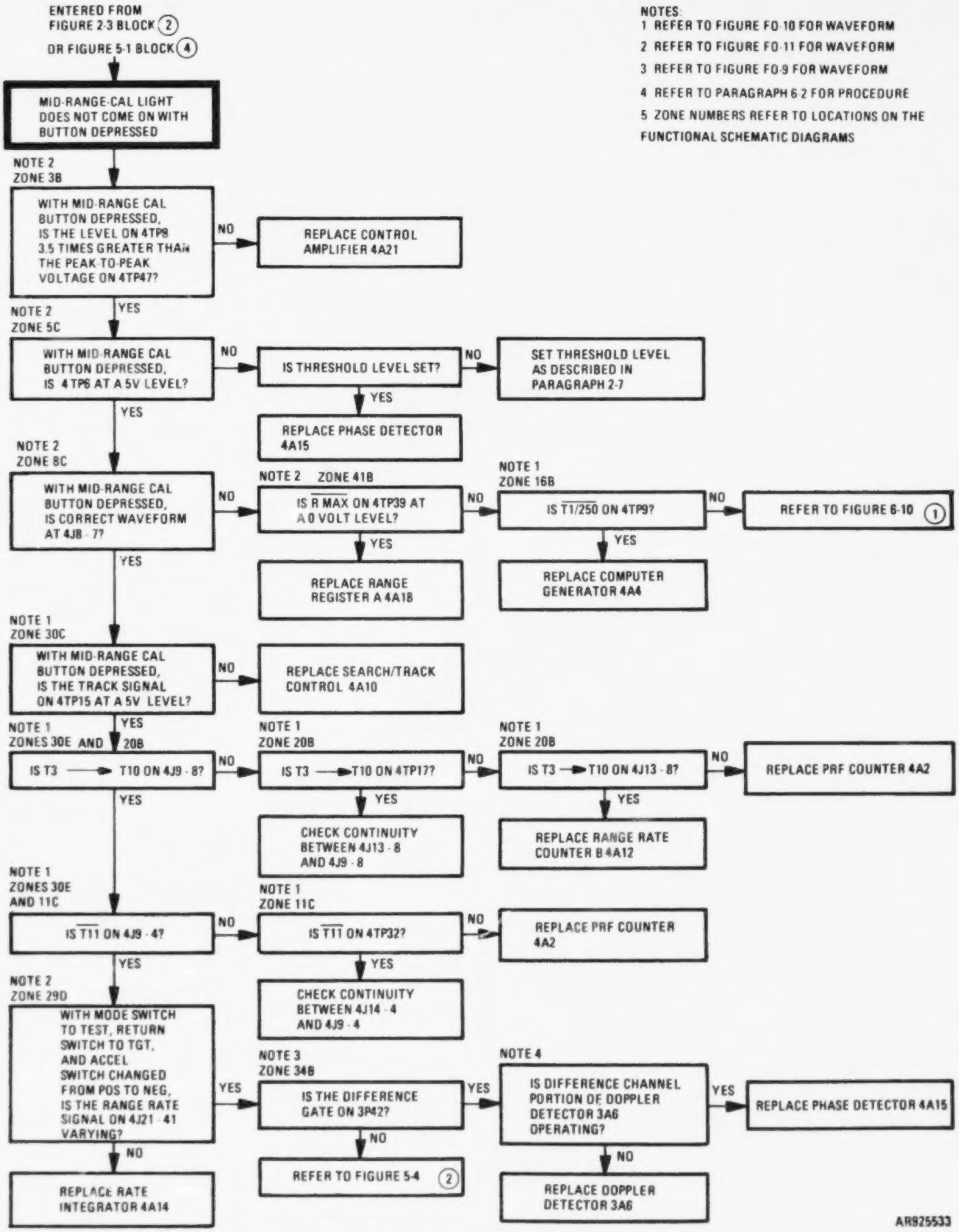

ENTER FROM
FIGURE 2-4 BLOCK ③
OR
FIGURE 5-6 BLOCK ②
OR
FO-7 BLOCK ①
NO MOD TRIG ON 4TP45
NOTE 1
ZONES 18C
AND 11A
IS $\overline{PRF}$ ON 4J26-10?
NO
CHECK CONTINUITY
BETWEEN 4TP31
AND 4J26 - 10
YES
ZONE 19C
IS PRF ON 4J26 - 34?
NO
REPLACE UNIVERSAL
BOARD 4A23
YES
ZONE 22D
IS PRF ON 4J20 - 10?
NO
CHECK CONTINUITY
BETWEEN 4J20 - 10
AND 4J26 - 34
YES
ZONE 24D
IS MOD TRIG ON 4J20 - 45?
NO
REPLACE MODULATOR
GENERATOR 4A3
YES
CHECK CONTINUITY
BETWEEN 4TP45
AND 4J20 - 45

NOTES:

1. ZONE DESIGNATIONS REFER TO LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10
2. FOR TEST POINT LOCATIONS REFER TO FIGURE 6-11

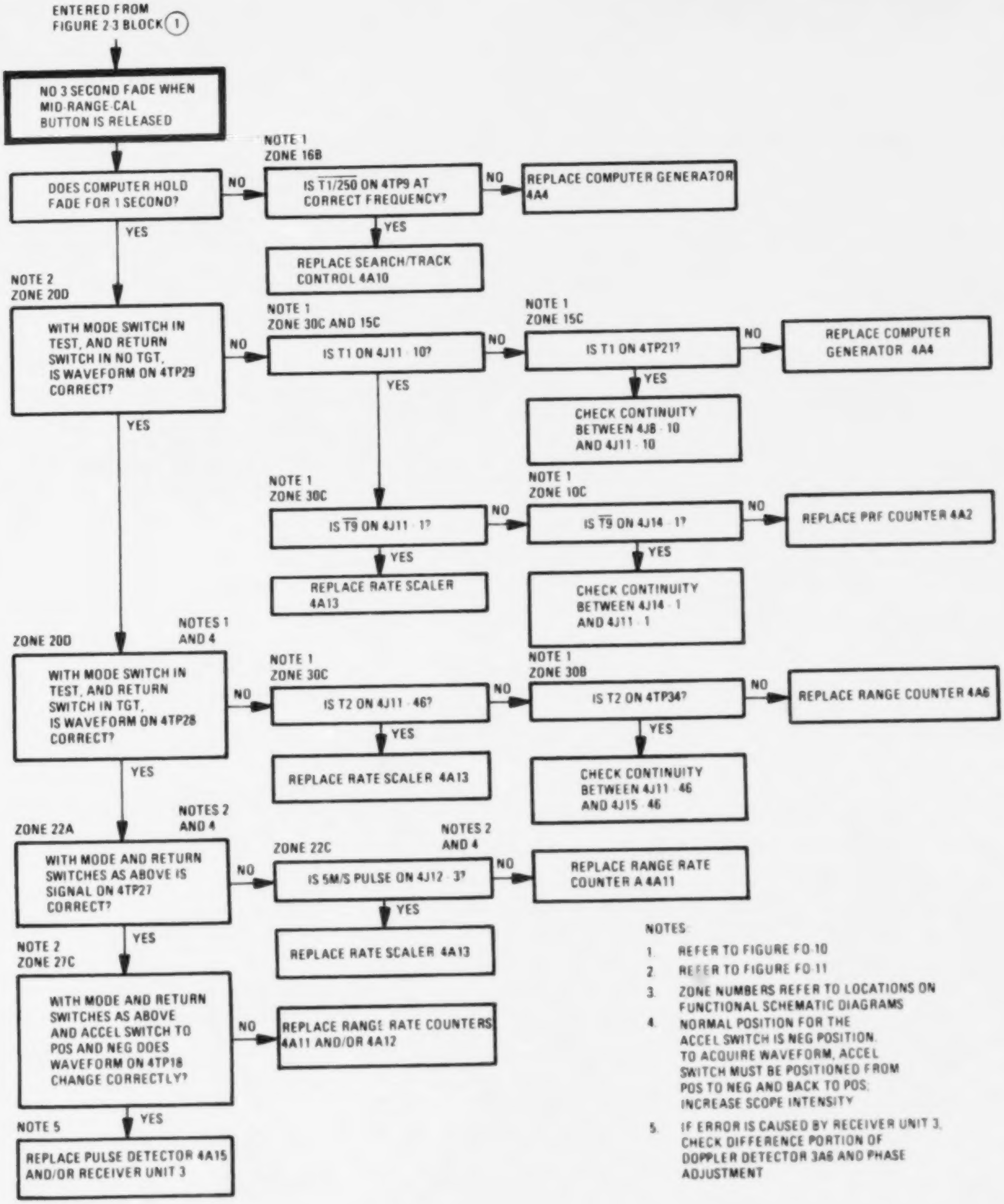
AR925532

Figure 6-6. MOD TRIG missing, fault localization diagram


ENTERED FROM
FIGURE 2-3 BLOCK ②
OR FIGURE 5-1 BLOCK ④
MID-RANGE-CAL LIGHT DOES NOT COME ON WITH BUTTON DEPRESSED
NOTE 2 ZONE 3B
WITH MID-RANGE CAL BUTTON DEPRESSED, IS THE LEVEL ON 4TP8 3.5 TIMES GREATER THAN THE PEAK-TO-PEAK VOLTAGE ON 4TP47?
NO
REPLACE CONTROL AMPLIFIER 4A21
YES
NOTE 2 ZONE 5C
WITH MID-RANGE CAL BUTTON DEPRESSED, IS 4TP6 AT A 5V LEVEL?
NO
IS THRESHOLD LEVEL SET?
NO
SET THRESHOLD LEVEL AS DESCRIBED IN PARAGRAPH 2-7
YES
REPLACE PHASE DETECTOR 4A15
YES
NOTE 2 ZONE 8C
WITH MID-RANGE CAL BUTTON DEPRESSED, IS CORRECT WAVEFORM AT 4J8 - 7?
NO
NOTE 2 ZONE 41B
IS $\overline{R}$ MAX ON 4TP39 AT A 0 VOLT LEVEL?
NO
NOTE 1 ZONE 16B
IS $\overline{T1/250}$ ON 4TP9?
NO
REFER TO FIGURE 6-10 ①
YES
REPLACE COMPUTER GENERATOR 4A4
YES
REPLACE RANGE REGISTER A 4A18
YES
NOTE 1 ZONE 30C
WITH MID-RANGE CAL BUTTON DEPRESSED, IS THE TRACK SIGNAL ON 4TP15 AT A 5V LEVEL?
NO
REPLACE SEARCH/TRACK CONTROL 4A10
YES
NOTE 1 ZONES 30E AND 20B
IS T3 → T10 ON 4J9 - 8?
NO
NOTE 1 ZONE 20B
IS T3 → T10 ON 4TP17?
NO
NOTE 1 ZONE 20B
IS T3 → T10 ON 4J13 - 8?
NO
REPLACE PRF COUNTER 4A2
YES
REPLACE RANGE RATE COUNTER B 4A12
YES
CHECK CONTINUITY BETWEEN 4J13 - 8 AND 4J9 - 8
YES
NOTE 1 ZONES 30E AND 11C
IS $\overline{T11}$ ON 4J9 - 4?
NO
NOTE 1 ZONE 11C
IS $\overline{T11}$ ON 4TP32?
NO
REPLACE PRF COUNTER 4A2
YES
CHECK CONTINUITY BETWEEN 4J14 - 4 AND 4J9 - 4
YES
NOTE 2 ZONE 29D
WITH MODE SWITCH TO TEST, RETURN SWITCH TO TGT, AND ACCEL SWITCH CHANGED FROM POS TO NEG, IS THE RANGE RATE SIGNAL ON 4J21 - 41 VARYING?
YES
NOTE 3 ZONE 34B
IS THE DIFFERENCE GATE ON 3P42?
YES
NOTE 4
IS DIFFERENCE CHANNEL PORTION OF DOPPLER DETECTOR 3A6 OPERATING?
YES
REPLACE PHASE DETECTOR 4A15
NO
REPLACE DOPPLER DETECTOR 3A6
NO
REFER TO FIGURE 5-4 ②
NO
REPLACE RATE INTEGRATOR 4A14
AR925533

NOTES:
1 REFER TO FIGURE FO-10 FOR WAVEFORM
2 REFER TO FIGURE FO-11 FOR WAVEFORM
3 REFER TO FIGURE FO-9 FOR WAVEFORM
4 REFER TO PARAGRAPH 6-2 FOR PROCEDURE
5 ZONE NUMBERS REFER TO LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAMS

Figure 6-7. No mid-range calibration, fault localization diagram


ENTERED FROM FIGURE 2-3 BLOCK ①
NO 3 SECOND FADE WHEN MID-RANGE-CAL BUTTON IS RELEASED
DOES COMPUTER HOLD FADE FOR 1 SECOND?
NO
NOTE 1
ZONE 16B
IS $\overline{T1/250}$ ON 4TP9 AT CORRECT FREQUENCY?
NO
REPLACE COMPUTER GENERATOR 4A4
YES
REPLACE SEARCH/TRACK CONTROL 4A10
YES
NOTE 2
ZONE 20D
WITH MODE SWITCH IN TEST, AND RETURN SWITCH IN NO TGT, IS WAVEFORM ON 4TP29 CORRECT?
NO
NOTE 1
ZONE 30C AND 15C
IS T1 ON 4J11 - 10?
NO
NOTE 1
ZONE 15C
IS T1 ON 4TP21?
NO
REPLACE COMPUTER GENERATOR 4A4
YES
CHECK CONTINUITY BETWEEN 4J8 - 10 AND 4J11 - 10
YES
NOTE 1
ZONE 30C
IS $\overline{T9}$ ON 4J11 - 1?
NO
NOTE 1
ZONE 10C
IS $\overline{T9}$ ON 4J14 - 1?
NO
REPLACE PRF COUNTER 4A2
YES
REPLACE RATE SCALER 4A13
YES
CHECK CONTINUITY BETWEEN 4J14 - 1 AND 4J11 - 1
YES
ZONE 20D
NOTES 1 AND 4
WITH MODE SWITCH IN TEST, AND RETURN SWITCH IN TGT, IS WAVEFORM ON 4TP28 CORRECT?
NO
NOTE 1
ZONE 30C
IS T2 ON 4J11 - 46?
NO
NOTE 1
ZONE 30B
IS T2 ON 4TP34?
NO
REPLACE RANGE COUNTER 4A6
YES
REPLACE RATE SCALER 4A13
YES
CHECK CONTINUITY BETWEEN 4J11 - 46 AND 4J15 - 46
YES
ZONE 22A
NOTES 2 AND 4
WITH MODE AND RETURN SWITCHES AS ABOVE IS SIGNAL ON 4TP27 CORRECT?
NO
ZONE 22C
IS 5M/S PULSE ON 4J12 - 3?
NOTES 2 AND 4
NO
REPLACE RANGE RATE COUNTER A 4A11
YES
REPLACE RATE SCALER 4A13
YES
NOTE 2
ZONE 27C
WITH MODE AND RETURN SWITCHES AS ABOVE AND ACCEL SWITCH TO POS AND NEG DOES WAVEFORM ON 4TP18 CHANGE CORRECTLY?
NO
REPLACE RANGE RATE COUNTERS 4A11 AND/OR 4A12
YES
NOTE 5
REPLACE PULSE DETECTOR 4A15 AND/OR RECEIVER UNIT 3

NOTES:

1. REFER TO FIGURE FO-10
2. REFER TO FIGURE FO-11
3. ZONE NUMBERS REFER TO LOCATIONS ON FUNCTIONAL SCHEMATIC DIAGRAMS
4. NORMAL POSITION FOR THE ACCEL SWITCH IS NEG POSITION. TO ACQUIRE WAVEFORM, ACCEL SWITCH MUST BE POSITIONED FROM POS TO NEG AND BACK TO POS; INCREASE SCOPE INTENSITY
5. IF ERROR IS CAUSED BY RECEIVER UNIT 3, CHECK DIFFERENCE PORTION OF DOPPLER DETECTOR 3A6 AND PHASE ADJUSTMENT

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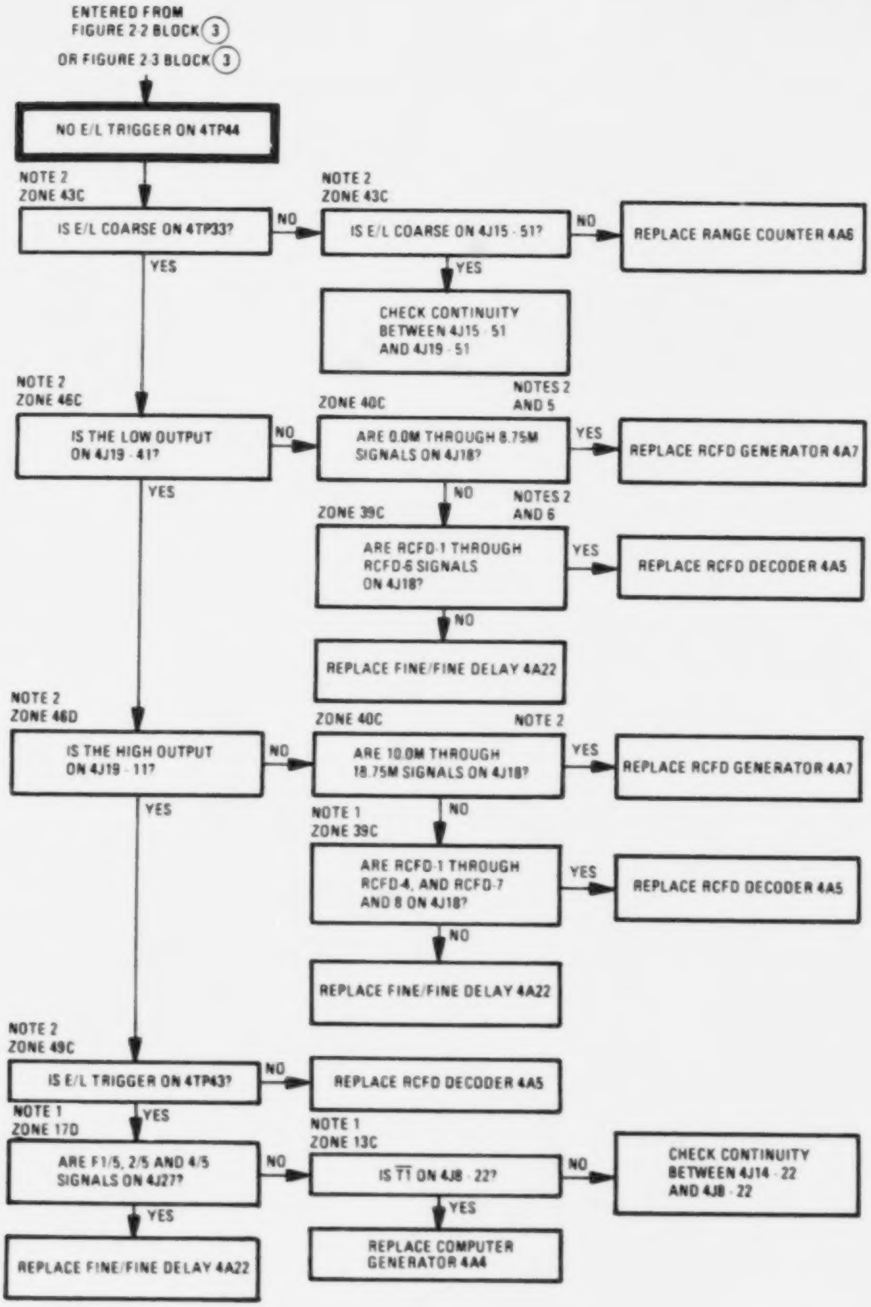
Figure 6-8. No 3-second fade, fault localization diagram


ENTERED FROM
FIGURE 2-2 BLOCK ③
OR FIGURE 2-3 BLOCK ③
NO E/L TRIGGER ON 4TP44
NOTE 2
ZONE 43C
IS E/L COARSE ON 4TP33?
NO
NOTE 2
ZONE 43C
IS E/L COARSE ON 4J15 - 51?
NO
REPLACE RANGE COUNTER 4A6
YES
CHECK CONTINUITY BETWEEN 4J15 - 51 AND 4J19 - 51
YES
NOTE 2
ZONE 46C
IS THE LOW OUTPUT ON 4J19 - 41?
NO
ZONE 40C
NOTES 2 AND 5
ARE 0.0M THROUGH 8.75M SIGNALS ON 4J18?
YES
REPLACE RCFD GENERATOR 4A7
YES
NO
NOTES 2 AND 6
ZONE 39C
ARE RCFD-1 THROUGH RCFD-6 SIGNALS ON 4J18?
YES
REPLACE RCFD DECODER 4A5
NO
REPLACE FINE/FINE DELAY 4A22
NOTE 2
ZONE 46D
IS THE HIGH OUTPUT ON 4J19 - 11?
NO
ZONE 40C
NOTE 2
ARE 10.0M THROUGH 18.75M SIGNALS ON 4J18?
YES
REPLACE RCFD GENERATOR 4A7
YES
NO
NOTE 1
ZONE 39C
ARE RCFD-1 THROUGH RCFD-4, AND RCFD-7 AND 8 ON 4J18?
YES
REPLACE RCFD DECODER 4A5
NO
REPLACE FINE/FINE DELAY 4A22
NOTE 2
ZONE 49C
IS E/L TRIGGER ON 4TP43?
NO
REPLACE RCFD DECODER 4A5
NOTE 1
ZONE 17D
YES
ARE F1/5, 2/5 AND 4/5 SIGNALS ON 4J27?
NO
NOTE 1
ZONE 13C
IS $\overline{T1}$ ON 4J8 - 22?
NO
CHECK CONTINUITY BETWEEN 4J14 - 22 AND 4J8 - 22
YES
REPLACE FINE/FINE DELAY 4A22
YES
REPLACE COMPUTER GENERATOR 4A4

NOTES:

1. REFER TO FIGURE FO-10
2. REFER TO FIGURE FO-11
3. REFER TO FIGURE 6-11 FOR TEST POINT LOCATIONS
4. ZONE NUMBERS REFER TO THE LOCATIONS ON THE FUNCTIONAL SCHEMATIC DIAGRAMS
5. SYNC ON 4J18 - 48. PULSE SHOULD MOVE FROM LEFT TO RIGHT IN STEPS. TIME/DIV. 0.1 MS
6. SYNC ON 4J18 - 42
   RCFD 1, 2 & 3, TIME/DIV 0.2 MS
   RCFD 4, 5 & 6, TIME/DIV 1.0 MS
   PULSES SHOULD MOVE FROM LEFT TO RIGHT IN STEPS

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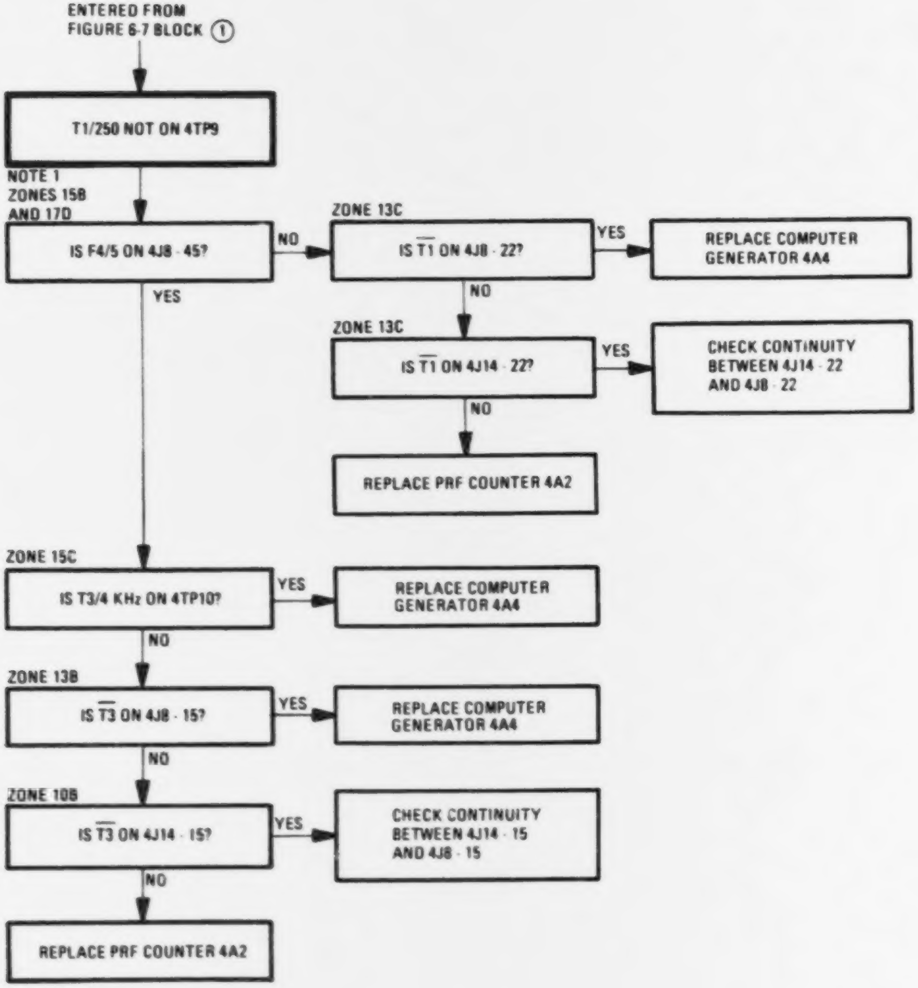
Figure 6-9. No E/L trigger, fault localization diagram


ENTERED FROM
FIGURE 6-7 BLOCK ①
T1/250 NOT ON 4TP9
NOTE 1
ZONES 15B
AND 17D
IS F4/5 ON 4J8 - 45?
NO
ZONE 13C
IS $\overline{T1}$ ON 4J8 - 22?
YES
REPLACE COMPUTER GENERATOR 4A4
NO
ZONE 13C
IS $\overline{T1}$ ON 4J14 - 22?
YES
CHECK CONTINUITY BETWEEN 4J14 - 22 AND 4J8 - 22
NO
REPLACE PRF COUNTER 4A2
YES
ZONE 15C
IS T3/4 KHz ON 4TP10?
YES
REPLACE COMPUTER GENERATOR 4A4
NO
ZONE 13B
IS $\overline{T3}$ ON 4J8 - 15?
YES
REPLACE COMPUTER GENERATOR 4A4
NO
ZONE 10B
IS $\overline{T3}$ ON 4J14 - 15?
YES
CHECK CONTINUITY BETWEEN 4J14 - 15 AND 4J8 - 15
NO
REPLACE PRF COUNTER 4A2

1. REFER TO FIGURE FO-10
2. ZONE NUMBERS REFER TO LOCATIONS ON FUNCTIONAL SCHEMATIC DIAGRAMS
3. REFER TO TEST POINT LOCATION DIAGRAM FIGURE 6-11

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Figure 6-10. T1/250 pulse loss, fault localization diagram

g. Check that the range rate voltage on TP3 of range rate D/A converter 4A17 is approximately +10 Vdc. If voltage is below +9 Vdc, replace range rate D/A converter 4A17.

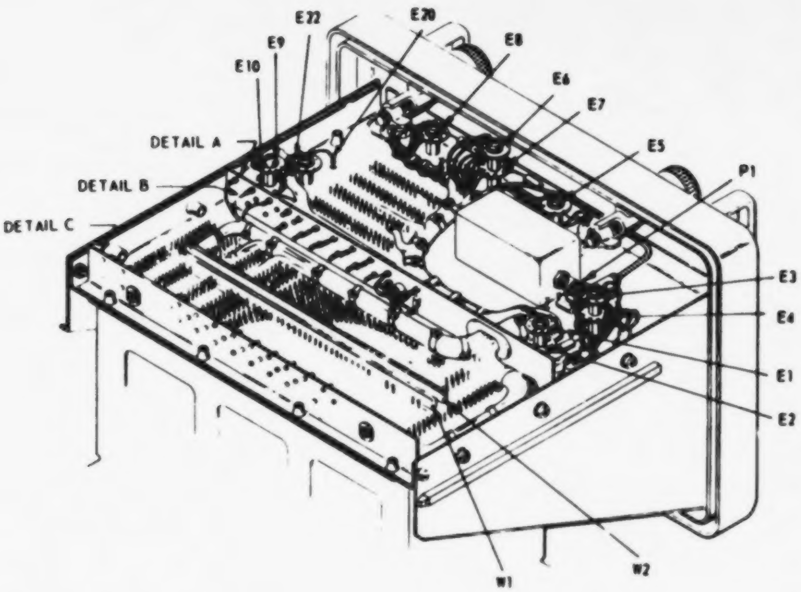
h. Check that the range voltage on TP3 of range D/A converter 4A16 repeatedly increases from 0 Vdc to approximately +20 Vdc in 17 seconds.

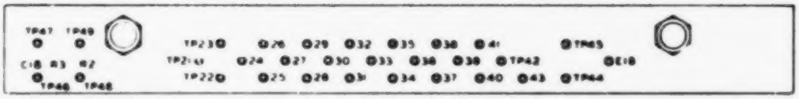
If maximum voltage is below +19 Vdc, replace range D/A converter 4A16.

i. Return the MODE switch to NORM.

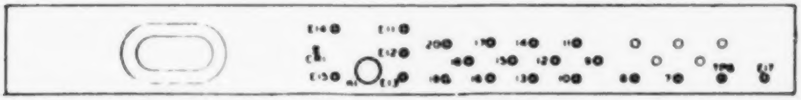
6-4. Computer Unit 4 Troubleshooting. Figure FO-10 is the functional schematic diagram you will use when troubleshooting the synchronizing system of the computer unit 4. Figure FO-11 is the functional schematic diagram you will use when troubleshooting the ranging system of the computer unit 4. The schematics have the test points designated in the fault localization diagrams and the voltage or waveforms measured at the test points.

6-5. Computer Unit 4 Test Point Location. Figure 6-11 is the test point location diagram for the computer unit 4. The test points are positioned as viewed with the computer unit 4 resting on its back side. Figure 6-12 is the connector pin layout for the computer unit 4. All connectors are viewed as looking at the front of the panel.

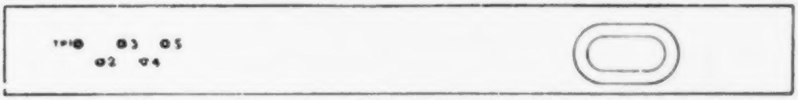

E22
E20
E9
E10
E8
E6
E7
DETAIL A
DETAIL B
DETAIL C
E5
P1
E3
E4
E1
E2
W1
W2


TP47
TP49
C18
R3
R2
TP46
TP48
TP23
TP21
TP22
26
29
32
35
38
41
24
27
30
33
36
39
25
28
31
34
37
40
43
TP45
TP42
TP44
E18

DETAIL C


E14
E11
E12
E15
E13
20
17
14
11
18
15
12
9
19
16
13
10
8
7
E17

DETAIL B



DETAIL A

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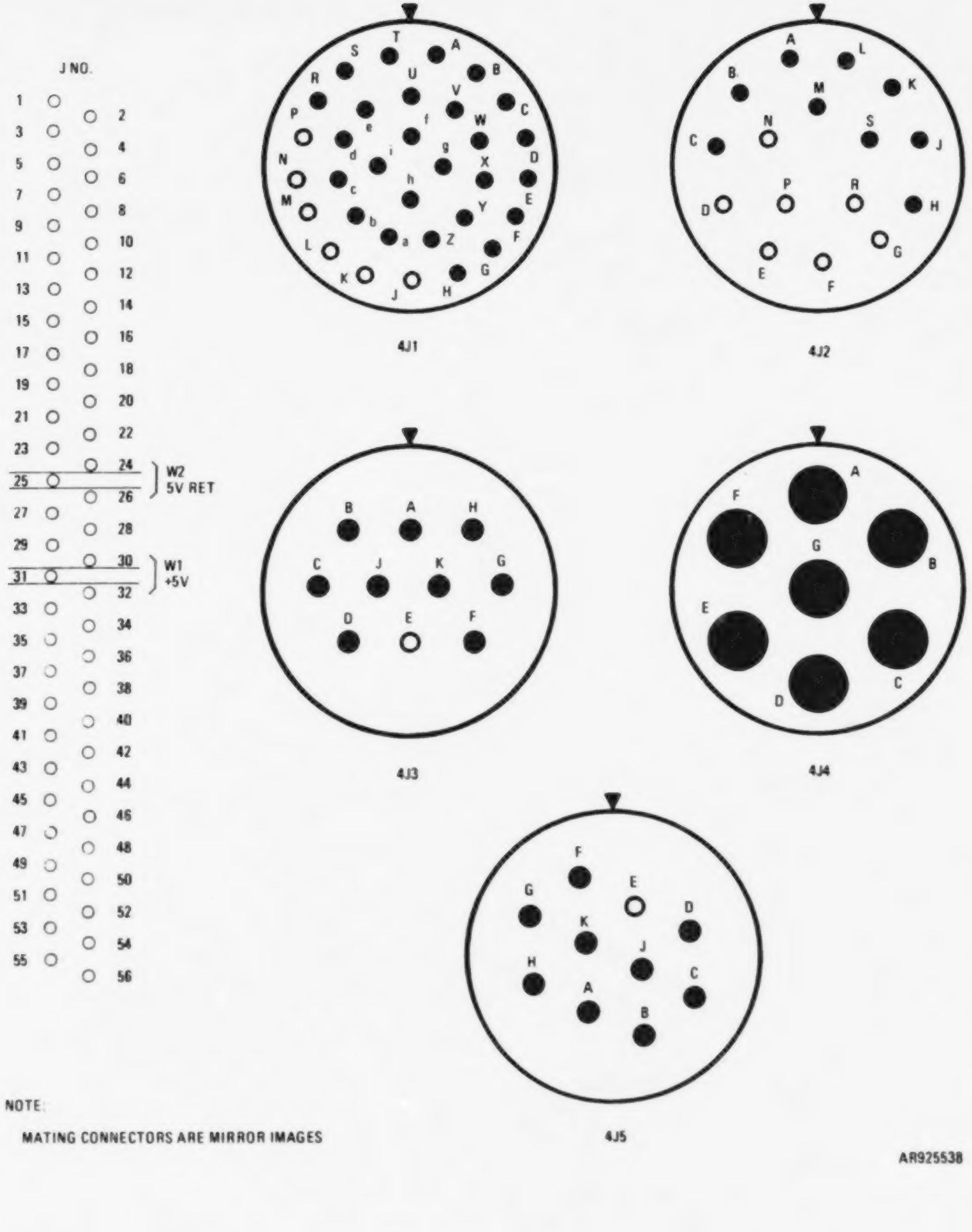
Figure 6-11. Computer unit 4, test point location


J NO.
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56
W2
5V RET
W1
+5V
T A B C D E F G H J K L M N P R S U V W X Y Z a b c d e f g h i
A L K J H G F E D C B M N S P R
B A H C J K G D E F
A B C D E F G
F E D C B A G H K J

4J1

4J2

4J3

4J4

4J5

NOTE:

MATING CONNECTORS ARE MIRROR IMAGES

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Figure 6-12. Computer unit 4, connector pin layout

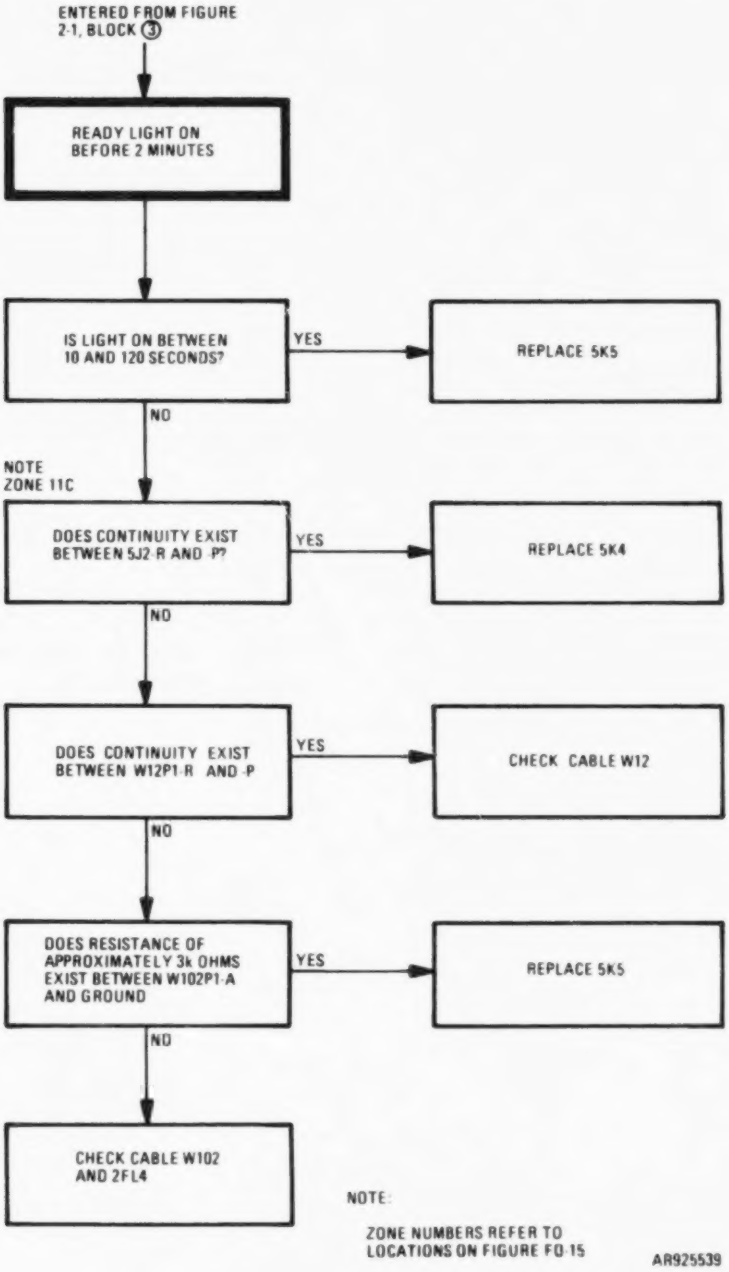
CHAPTER 7

POWER SUPPLY UNIT 5 SUBSYSTEM FAULT LOCALIZATION

7-1. Power Supply Unit 5 Fault Localization. This chapter contains the diagrams you will use when a failure is localized to the power supply unit 5 subsystem as indicated from the checks performed in figure 2-1. Figure 7-1 is used to locate a failure causing the READY WHEN LIT light to come on before the 2-minute time delay has elapsed. Figure 7-2 is used to locate a failure which prevents the READY WHEN LIT light coming on after the 2-minute time delay has elapsed. Figure 7-3 will be used to locate a failure causing the loss of 28 volts on 2P18 of the klystron power supply 2A2. Figure FO-12 is used to locate a failure when either or both blowers in units 2 and 5 are not running. Figure 7-4 will be used to locate a failure causing the loss of 24 volts on 2P18 of the klystron power supply 2A2. Figure FO-13 will be used to locate a failure causing one or all of the power supply unit 5 measurements to be out of tolerance.

7-2. Power Supply Unit 5 Troubleshooting. Figures FO-14 through FO-18 are the functional schematic diagrams you will use when troubleshooting the power supply unit 5 subsystem. Waveforms and test points are not included on the schematics because in all cases the measurement taken will be the power supply value or a continuity check.

7-3. Power Supply Unit 5 Component and Test Point Location. Figure 7-5 is the filter location drawing for the R/T unit 2, computer unit 4 and power supply unit 5. Figure 7-6 is the component and test point location diagram for units 2 and 5. Figure 7-7 identifies the connector pin locations for the cable and connectors used in this subsystem.


ENTERED FROM FIGURE 2-1, BLOCK ③
READY LIGHT ON BEFORE 2 MINUTES
IS LIGHT ON BETWEEN 10 AND 120 SECONDS?
YES
REPLACE 5K5
NO
NOTE ZONE 11C
DOES CONTINUITY EXIST BETWEEN 5J2-R AND -P?
YES
REPLACE 5K4
NO
DOES CONTINUITY EXIST BETWEEN W12P1-R AND -P
YES
CHECK CABLE W12
NO
DOES RESISTANCE OF APPROXIMATELY 3k OHMS EXIST BETWEEN W102P1-A AND GROUND
YES
REPLACE 5K5
NO
CHECK CABLE W102 AND 2FL4
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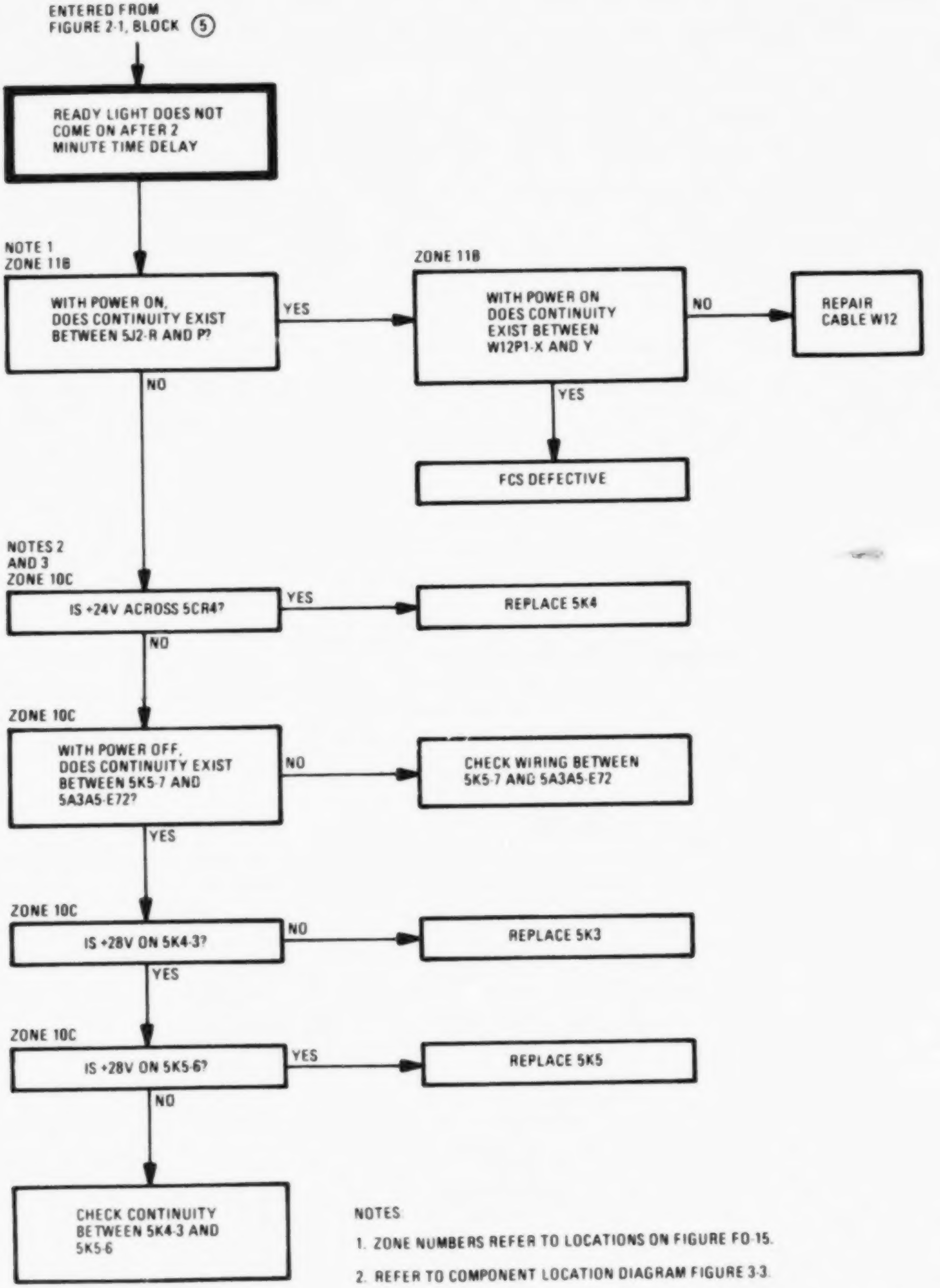
NOTE:

ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-15

Figure 7-1. Early READY WHEN LIT light, fault localization diagram


ENTERED FROM
FIGURE 2-1, BLOCK ⑤
READY LIGHT DOES NOT COME ON AFTER 2 MINUTE TIME DELAY
NOTE 1
ZONE 11B
WITH POWER ON, DOES CONTINUITY EXIST BETWEEN 5J2-R AND P?
YES
ZONE 11B
WITH POWER ON DOES CONTINUITY EXIST BETWEEN W12P1-X AND Y
NO
REPAIR CABLE W12
YES
FCS DEFECTIVE
NO
NOTES 2 AND 3
ZONE 10C
IS +24V ACROSS 5CR4?
YES
REPLACE 5K4
NO
ZONE 10C
WITH POWER OFF, DOES CONTINUITY EXIST BETWEEN 5K5-7 AND 5A3A5-E72?
NO
CHECK WIRING BETWEEN 5K5-7 AND 5A3A5-E72
YES
ZONE 10C
IS +28V ON 5K4-3?
NO
REPLACE 5K3
YES
ZONE 10C
IS +28V ON 5K5-6?
YES
REPLACE 5K5
NO
CHECK CONTINUITY BETWEEN 5K4-3 AND 5K5-6

NOTES

1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-15.
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 3-3.
3. +28V IS LOWER DUE TO DROP ACROSS RELAY COIL AND DIODE.

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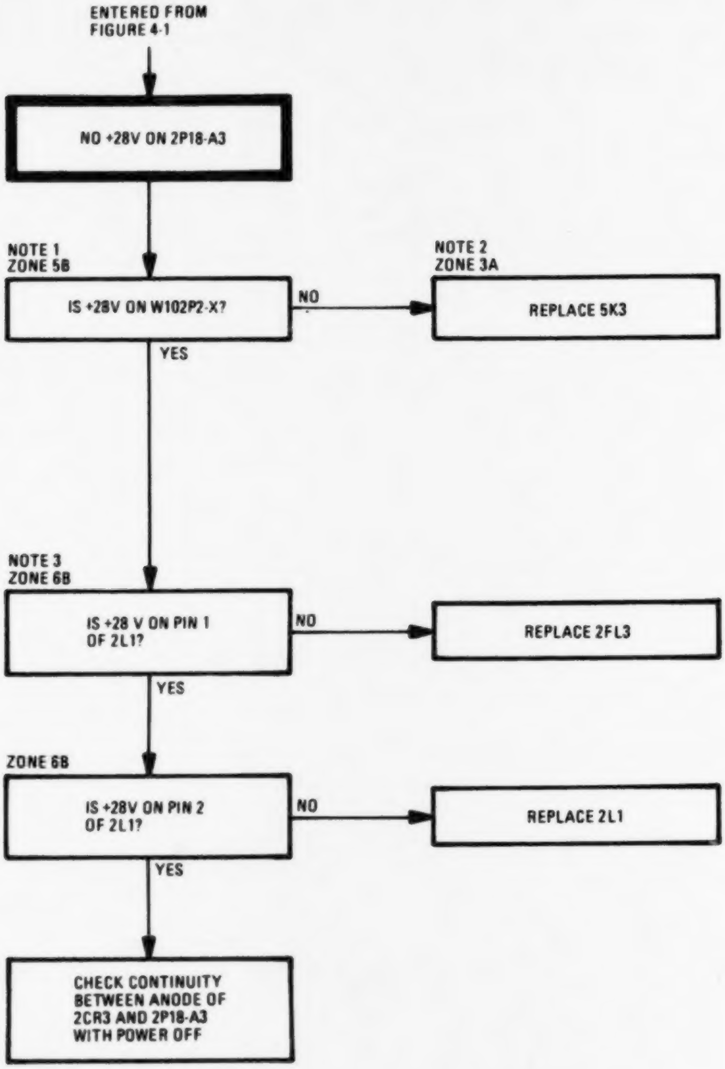
Figure 7-2. No READY WHEN LIT light, fault localization diagram


ENTERED FROM FIGURE 4-1
NO +28V ON 2P18-A3
NOTE 1 ZONE 5B
IS +28V ON W102P2-X?
NO
NOTE 2 ZONE 3A
REPLACE 5K3
YES
NOTE 3 ZONE 6B
IS +28 V ON PIN 1 OF 2L1?
NO
REPLACE 2FL3
YES
ZONE 6B
IS +28V ON PIN 2 OF 2L1?
NO
REPLACE 2L1
YES
CHECK CONTINUITY BETWEEN ANODE OF 2CR3 AND 2P18-A3 WITH POWER OFF

NOTES:

1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-15.
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 3-2.
3. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 7-6.

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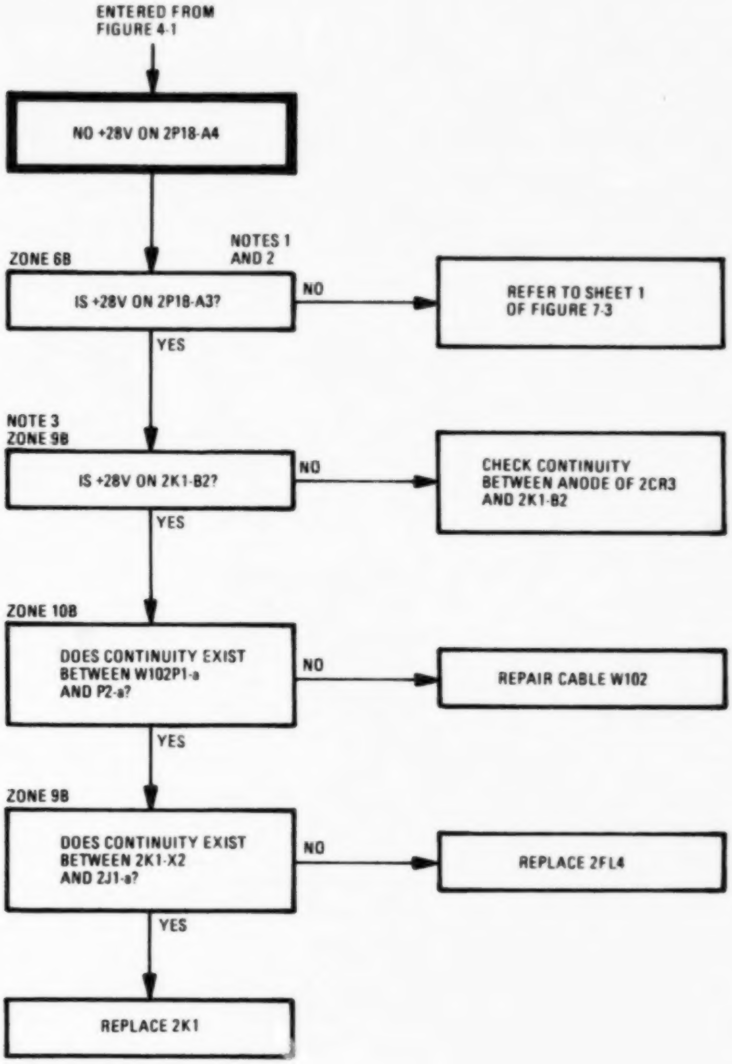
Figure 7-3. +28-volt power distribution loss on klystron power supply 2A2, fault localization diagram (sheet 1 of 2)


ENTERED FROM FIGURE 4-1
NO +28V ON 2P18-A4
ZONE 6B
NOTES 1 AND 2
IS +28V ON 2P18-A3?
NO
REFER TO SHEET 1 OF FIGURE 7-3
YES
NOTE 3
ZONE 9B
IS +28V ON 2K1-B2?
NO
CHECK CONTINUITY BETWEEN ANODE OF 2CR3 AND 2K1-B2
YES
ZONE 10B
DOES CONTINUITY EXIST BETWEEN W102P1-a AND P2-a?
NO
REPAIR CABLE W102
YES
ZONE 9B
DOES CONTINUITY EXIST BETWEEN 2K1-X2 AND 2J1-a?
NO
REPLACE 2FL4
YES
REPLACE 2K1

NOTES:

1. ZONE NUMBERS REFER TO LOCATION ON FIGURE FO-15.
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 7-6.
3. REMOVE RELAY 2K1.

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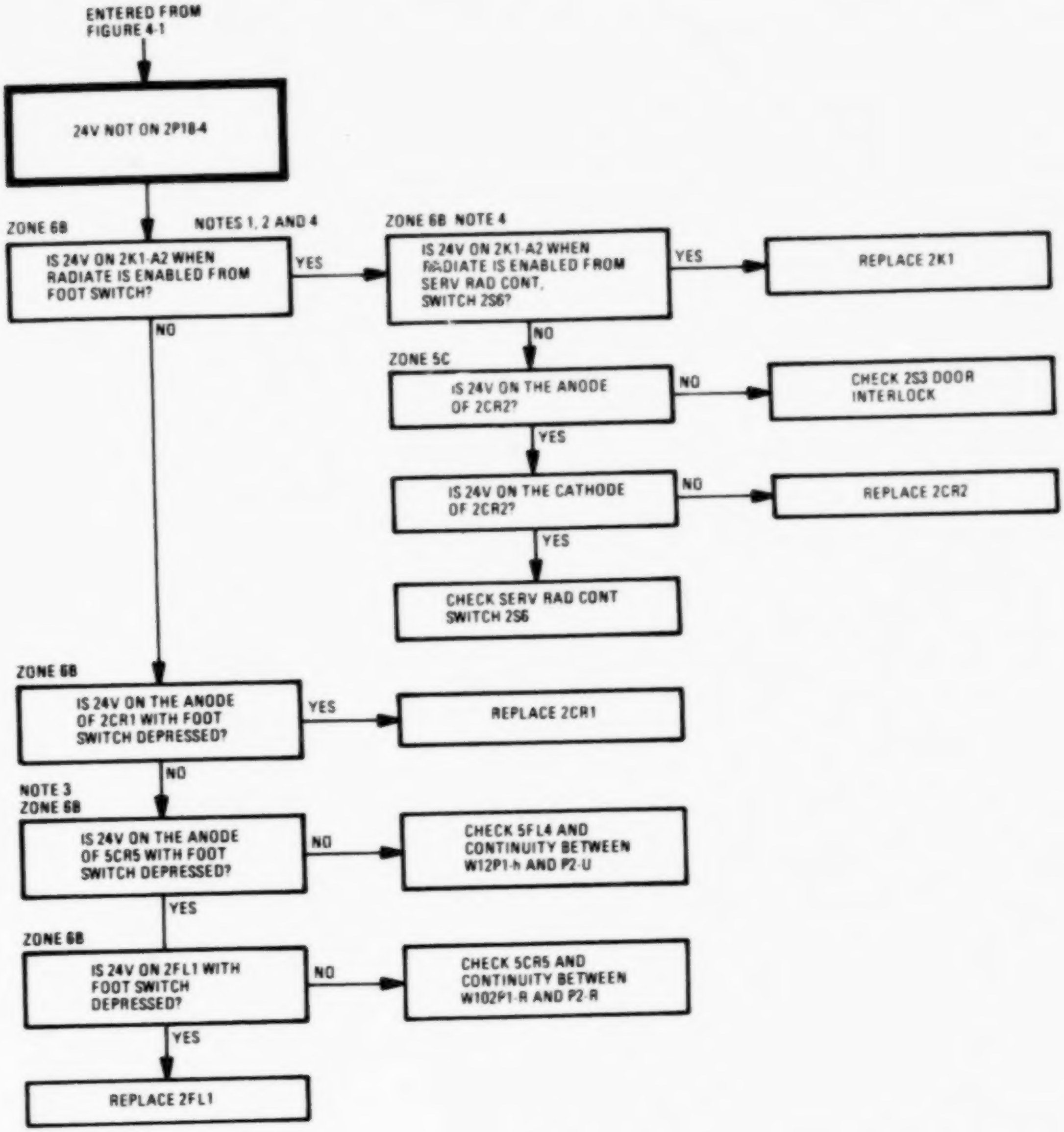
Figure 7-3. +28-volt power distribution loss on klystron power supply 2A2, fault localization diagram (sheet 2 of 2)


ENTERED FROM
FIGURE 4-1
24V NOT ON 2P18-4
ZONE 6B
NOTES 1, 2 AND 4
IS 24V ON 2K1-A2 WHEN RADIATE IS ENABLED FROM FOOT SWITCH?
YES
ZONE 6B NOTE 4
IS 24V ON 2K1-A2 WHEN RADIATE IS ENABLED FROM SERV RAD CONT, SWITCH 2S6?
YES
REPLACE 2K1
NO
NO
ZONE 5C
IS 24V ON THE ANODE OF 2CR2?
NO
CHECK 2S3 DOOR INTERLOCK
YES
IS 24V ON THE CATHODE OF 2CR2?
NO
REPLACE 2CR2
YES
CHECK SERV RAD CONT SWITCH 2S6
ZONE 6B
IS 24V ON THE ANODE OF 2CR1 WITH FOOT SWITCH DEPRESSED?
YES
REPLACE 2CR1
NO
NOTE 3
ZONE 6B
IS 24V ON THE ANODE OF 5CR5 WITH FOOT SWITCH DEPRESSED?
NO
CHECK 5FL4 AND CONTINUITY BETWEEN W12P1-h AND P2-U
YES
ZONE 6B
IS 24V ON 2FL1 WITH FOOT SWITCH DEPRESSED?
NO
CHECK 5CR5 AND CONTINUITY BETWEEN W102P1-R AND P2-R
YES
REPLACE 2FL1

NOTES:

1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-14.
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 7-6.
3. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 3-4.
4. REMOVE 2K1.

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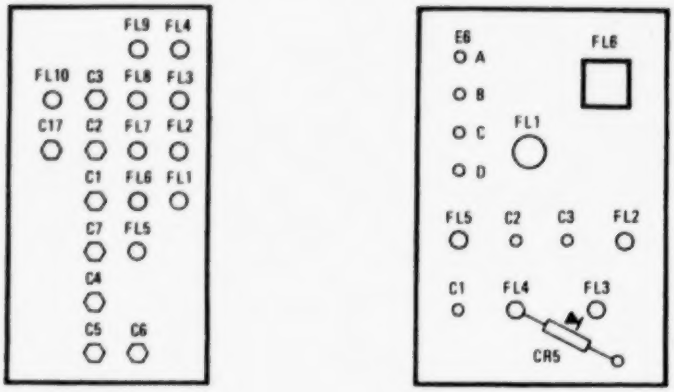
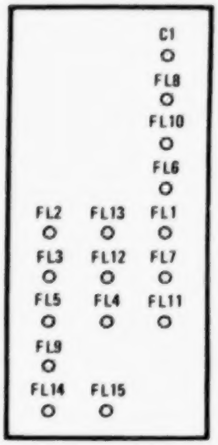
Figure 7-4. +24-volt power distribution loss on klystron power supply 2A2, fault localization diagram


FL9
FL4
FL10
C3
FL8
FL3
C17
C2
FL7
FL2
C1
FL6
FL1
C7
FL5
C4
C5
C6
E6
A
B
C
D
FL6
FL1
FL5
C2
C3
FL2
C1
FL4
FL3
CR5

UNIT 4 FILTER LOCATION DRAWING.

UNIT 5 FILTER LOCATION DRAWING.


C1
FL8
FL10
FL6
FL2
FL13
FL1
FL3
FL12
FL7
FL5
FL4
FL11
FL9
FL14
FL15

UNIT 2 FILTER LOCATION DRAWING.

NOTE:

SEE FIGURE 7-6 FOR FILTERS 2FL16 AND 2FL17

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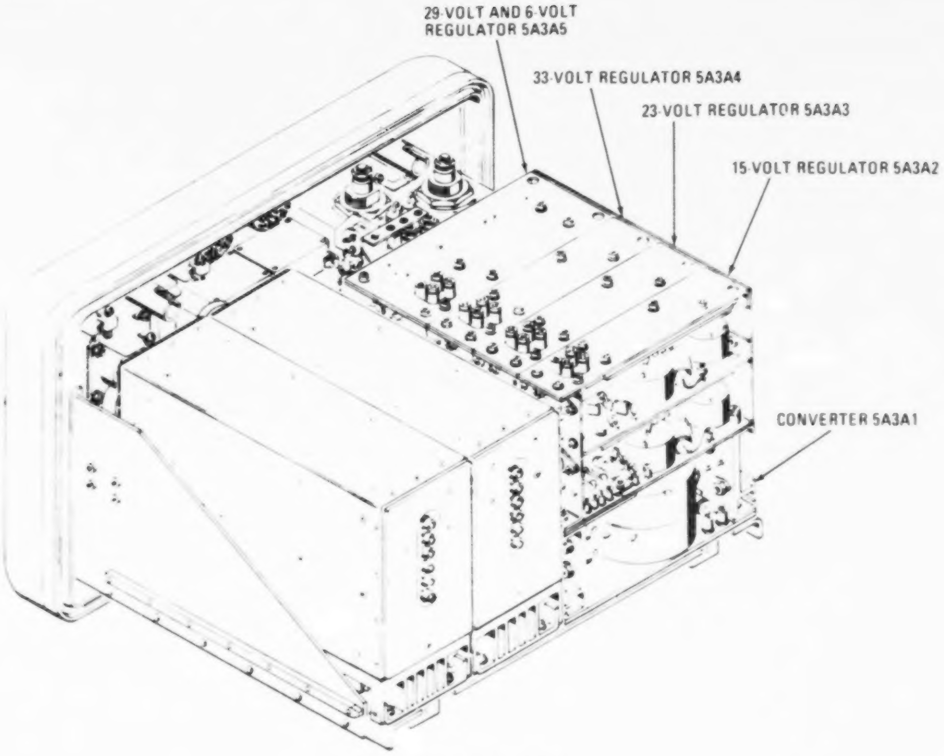
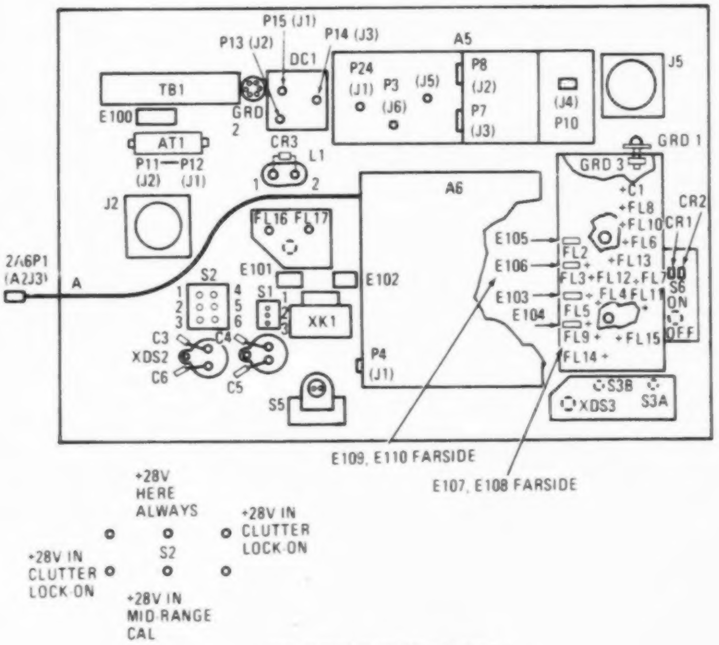
Figure 7-5. Receiver/transmitter unit 2, computer unit 4 and power supply unit 5, filter locations


29-VOLT AND 6-VOLT REGULATOR 5A3A5
33-VOLT REGULATOR 5A3A4
23-VOLT REGULATOR 5A3A3
15-VOLT REGULATOR 5A3A2
CONVERTER 5A3A1

POWER SUPPLY UNIT 5


P15 (J1)
P13 (J2)
P14 (J3)
DC1
A5
P24
(J1)
P3
(J6)
(J5)
P8
(J2)
P7
(J3)
(J4)
P10
J5
TB1
E100
GRD 2
AT1
P11—P12
(J2) (J1)
CR3
L1
1 2
GRD 1
GRD 3
C1
FL8
FL10
FL6
FL13
FL12
FL7
FL4
FL11
FL5
FL9
FL15
FL14
FL2
FL3
CR2
CR1
S6
ON
OFF
A6
J2
FL16 FL17
E105
E106
E103
E104
2A6P1
(A2J3)
A
S2
1 2 3 4 5 6
E101
E102
S1
1 2 3
XK1
C3
C4
XDS2
C6
C5
P4
(J1)
S5
S3B
XDS3
S3A
E109, E110 FARSIDE
E107, E108 FARSIDE
+28V HERE ALWAYS
+28V IN CLUTTER LOCK-ON
S2
+28V IN CLUTTER LOCK-ON
+28V IN MID-RANGE CAL

RECEIVER/TRANSMITTER UNIT 2

AR925545

Figure 7-6. Receiver/transmitter unit 2 and power supply unit 5, component and test point location

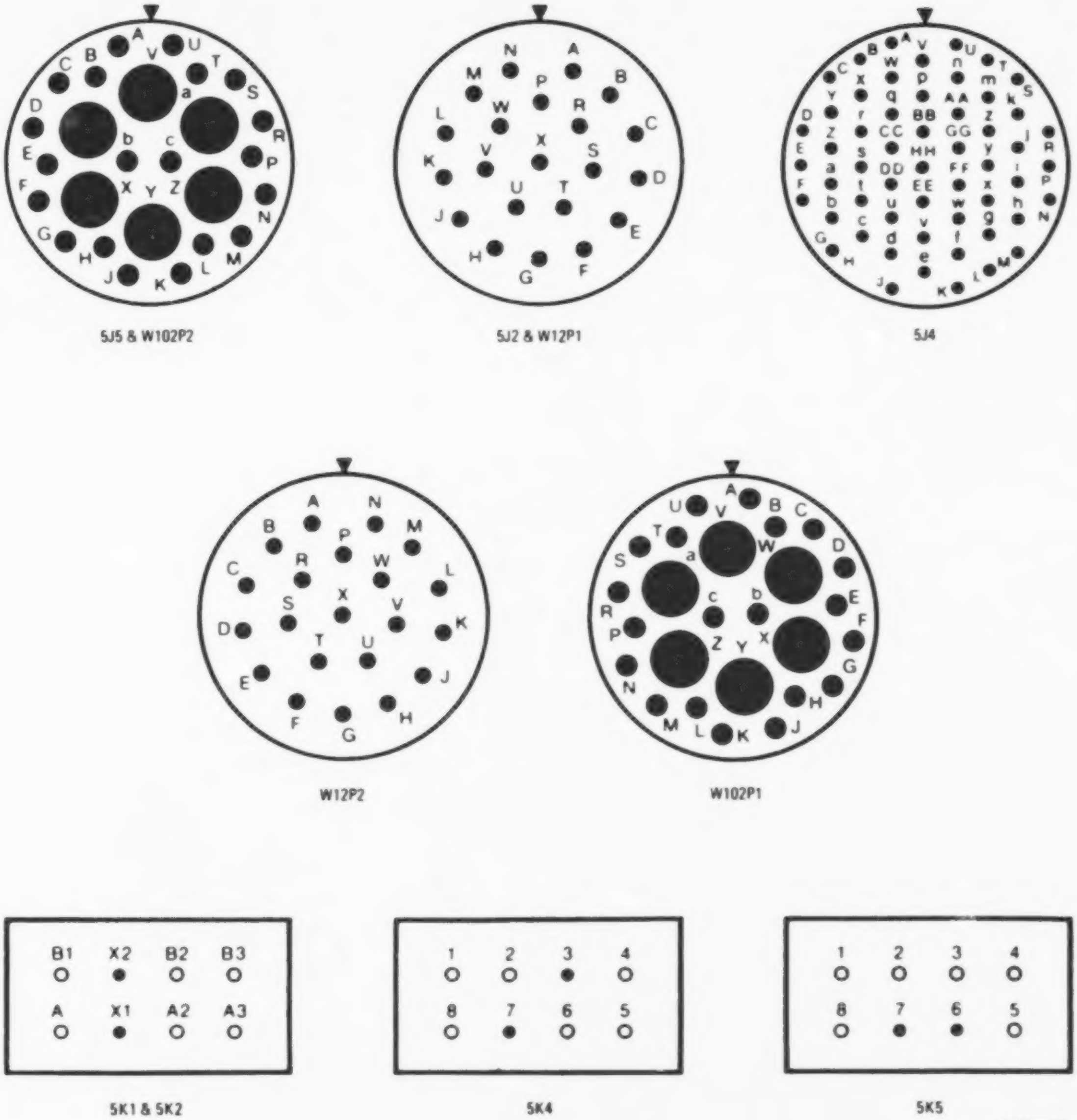

5J5 & W102P2
5J2 & W12P1
5J4
W12P2
W102P1
B1 X2 B2 B3
A X1 A2 A3
5K1 & 5K2
1 2 3 4
8 7 6 5
5K4
1 2 3 4
8 7 6 5
5K5
AR925546

Figure 7-7. Power supply unit 5, connector pin layout

CHAPTER 8

FINAL INSPECTION AND TEST

8-1. General. Final inspection and test is performed using the AN/VPM-2 radar system tester. These procedures and the associated troubleshooting procedures are for the overall AN/VPS-2 radar set as installed on either the M163A1 (self-propelled) or M167A1 (towed) vehicles.

8-2. Operating Location.

a. Self Propelled Vehicle (M163A1). When testing a radar set mounted on a self-propelled vehicle, locate the AN/VPM-2 system tester on a flat surface adjacent to the commander's hatch or within the main body of the vehicle.

b. Towed Vehicle (M167A1). When testing a radar set mounted on a towed vehicle, locate the AN/VPM-2 system tester on the ground or on a maintenance vehicle near the antenna unit 1.

8-3. AN/VPM-2 System Tester Self-Test.

NOTE

Perform self-test procedure before radar tests are performed.

a. Voltage Checks

(1) Connect the equipment as shown in figure 8-1. Do not connect flexible cable W5 at this time.

NOTE

Anytime the AN/VPM-2 system tester power is interrupted for more than 15 minutes, voltage checks and self-checks should be repeated to ensure that the equipment is fully operational before continuing any tests.

(2) Set the AN/VPM-2 system tester controls as follows:

Control	Position
POWER	OFF
FUNCTION SELECT	VOLTAGE
VOLTAGE SELECT	+24
RF LEVEL	20 dB
FREQ SELECT	Radar transmit frequency (Refer to Table 8-1)
MODE SELECT	SELF TEST
PHASE CONTROL	MID RANGE
CLUTTER	OFF
CLUTTER LEVEL	20 dB
RANGE SELECT	R3
TARGET LEVEL	27 dB
TARGET FREEZE	OFF
TARGET	OFF

(3) Adjust the APU for a voltage indication between +28 and +29 Vdc and assure current load meter reads less than 100%.

(4) Set the following system switches as follows:

(a) Distribution box NORM-STATIC-TEST switch: STATIC

(b) System control panel

1. SYSTEM POWER switch: OFF

2. GUN POWER switch: OFF

3. MODE switch: RADAR

(c) M61 Sight: mechanically caged.

(d) Antenna MODE switch to STOW.

(e) SYSTEM POWER switch to ON.

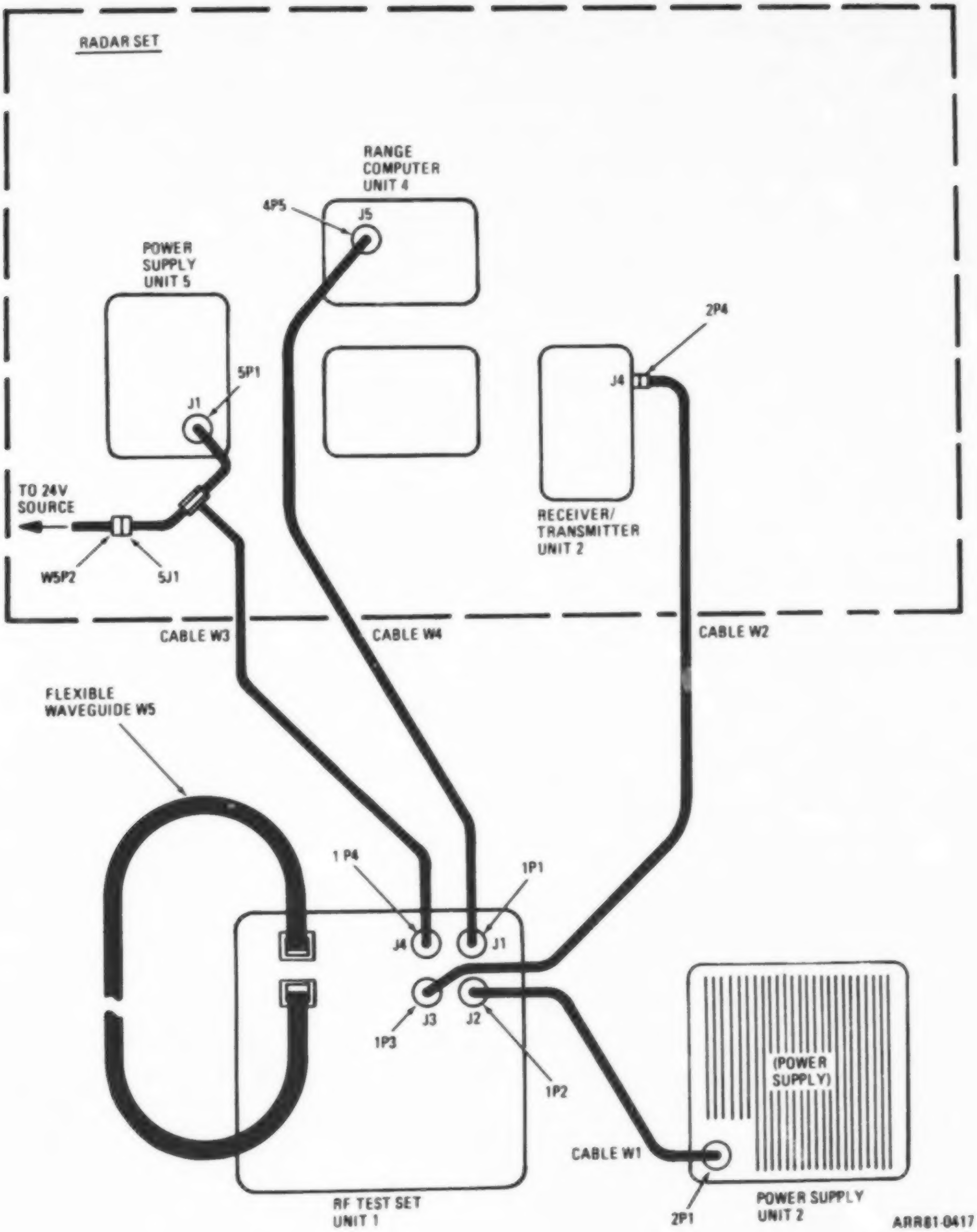

RADAR SET
RANGE COMPUTER UNIT 4
4P5
J5
POWER SUPPLY UNIT 5
2P4
5P1
J1
J4
TO 24V SOURCE
W5P2
5J1
RECEIVER/ TRANSMITTER UNIT 2
CABLE W3
CABLE W4
CABLE W2
FLEXIBLE WAVEGUIDE W5
1 P4
1P1
J4
J1
J3
J2
1P3
(POWER SUPPLY)
1P2
CABLE W1
2P1
RF TEST SET UNIT 1
POWER SUPPLY UNIT 2
ARR81-0417

Figure 8-1. AN/VPM-2 system tester self test, equipment setup

Table 8-1. Radar Transmit Frequencies*

VPM-2 FREQ SELECT Setting (Radar Transmit Frequency GHz)	AN/VPS-2 Crystal Frequency (Radar Stalo Frequency GHz)	Channel No.
9.205	9.145	1
9.213	9.153	2
9.221	9.161	3
9.229	9.169	4
9.237	9.177	5
9.245	9.185	6

*Determine radar transmit frequency by inspecting frequency marking on crystal installed in X Band source of radar unit 2. Transmit frequency is 60 MHz above crystal frequency.

(5) On the AN/VPM-2 system tester, set POWER switch to ON. Check that the digital display is illuminated.

(6) Observe that the digital display indicates +24.0 ±5.0 Vdc.

(7) Set the VOLTAGE SELECT switch to the following positions. Record the digital display at each setting.

VOLTAGE SELECT	Digital Display (Vdc)
VOLT TP	0.0 ± 0.015
+5	+5.0 ± 0.2
+15	+15.0 ± 0.3
-15	-15.0 ± 0.3
+28	+28.0 ± 0.6

b. Self-Test

(1) RF Input

NOTE

Ensure that the pin on the flexible waveguide coupling flange is properly keyed to the RADAR port and that both waveguide sections are properly aligned.

(a) Connect flexible cable W5 between the RADAR port and the SELF TEST port of the AN/VPM-2 system tester.

(b) Set the FUNCTION SELECT switch to R.F. INPUT.

(c) Adjust the RF LEVEL control to obtain a digital display reading of 0.500 ± 0.075 Vdc. The RF LEVEL control setting should be greater than 3.0 dB.

(d) Set the FUNCTION SELECT switch to R.F. MONITOR.

(e) Adjust the RF LEVEL control to obtain a digital display reading of +2.500 ±0.075 Vdc.

(f) Vary the PHASE CONTROL over its entire range. The digital display should remain between +2.0 and 3.0 Vdc. Reset the PHASE CONTROL to mid-range.

(g) Adjust the RF LEVEL control to obtain a digital display reading of +2.500 ± 0.075 Vdc.

(h) Set the RANGE SELECT switch to R1, R2, and R4. The digital display should remain between +1.30 and 3.70 Vdc.

(i) Set the RANGE SELECT switch to R3. Set the CLUTTER switch to ON. Set the CLUTTER LEVEL control to 20 dB.

(j) Adjust the RF LEVEL control for a digital display reading of 2.500 ± 0.075 Vdc.

NOTE

The 2.500 ± 0.075 Vdc reading is a reference level injected into the target and clutter channels. Monitor and maintain this voltage throughout the procedure.

(k) Set the FUNCTION SELECT switch to RF SELF-TEST.

(l) Adjust the CLUTTER BALANCE for a digital display within ±0.1 Vdc of the value indicated on the AN/VPM-2 system tester calibration chart for RF self-test.

(m) Set the FUNCTION SELECT switch to RF MONITOR. Repeat step (j).

(n) Set the FUNCTION SELECT switch to RF SELF-TEST.

(o) Set the CLUTTER LEVEL control to 25 dB.

(p) Adjust the RF LEVEL control to obtain a digital display reading of 0.750 ± 0.050 Vdc.

(q) Set CLUTTER switch to OFF. Digital voltmeter should indicate less than 0.075 Vdc.

(r) Set the TARGET switch to ON and the TARGET LEVEL control to 27 dB.

(s) Set the TARGET switch to OFF. The digital display should indicate less than +0.075 Vdc.

(t) Set the CLUTTER switch to ON and record the reading on the digital display.

(u) Set the CLUTTER switch to OFF and the TARGET switch to ON.

(v) Adjust the TARGET BALANCE control for the same digital display reading obtained in step (t). Set TARGET switch to OFF.

(w) Alternately repeat steps (t) through (v) until the digital display indications in steps (t) and (v) are within ±0.025 Vdc.

NOTE

Do not readjust the CLUTTER BALANCE control.

(x) Set the CLUTTER and TARGET switches to OFF.

(2) RF level attenuator

(a) Set the FUNCTION SELECT to RF MONITOR.

(b) Adjust the RF LEVEL control for a reading of + 3.160 ± 0.025 Vdc on the digital display. Record the RF LEVEL control setting.

(c) Increase (higher number on dial) the RF LEVEL setting by 5.0 dB. The digital display should indicate 1.000 ± 0.25 Vdc.

(3) Clutter level attenuator

(a) Set the FUNCTION SELECT to RF MONITOR.

(b) Set the CLUTTER switch to ON.

(c) Adjust the RF LEVEL control for a reading of 3.000 ± 0.075 Vdc on the digital display. Record the RF LEVEL control setting.

(d) Set the FUNCTION SELECT to RF SELF TEST.

(e) Adjust the CLUTTER LEVEL control for a reading of + 3.000 ± 0.075 Vdc on the digital display. Record the CLUTTER LEVEL control setting.

(f) Increase (higher number on dial) the RF LEVEL setting by 5.0 dB.

(g) Decrease (lower number on dial) the CLUTTER LEVEL control to indicate 3.000 ± 0.075 Vdc on the digital display. Record the CLUTTER LEVEL control setting.

(h) Subtract the CLUTTER LEVEL control setting in step (g) from the CLUTTER LEVEL control setting in step (e). The reading should be between 4.0 and 6.0 dB.

(i) Repeat steps (f) through (h) in 5.0 dB increments. The last increment may be less than 5.0 dB.

(j) Set the CLUTTER switch to OFF.

(4) Target level attenuator.

(a) Set the FUNCTION SELECT switch to RF MONITOR. Set CLUTTER switch to ON.

(b) Adjust the RF LEVEL control for a reading of +3.000 ± 0.075 Vdc on the digital display. Record the RF LEVEL control setting.

(c) Set the FUNCTION SELECT to RF SELF TEST, the CLUTTER LEVEL control to 25 dB, and the TARGET LEVEL to 27 (fully cw).

(d) Increase (higher number on dial) the CLUTTER LEVEL setting by 5 dB. Record the digital display indication.

(e) Set the CLUTTER switch to OFF and the TARGET switch to ON.

(f) Increase (higher number on dial) the TARGET LEVEL control for the same DVM indication obtained in step (d) above ±.075VDC. Subtract 27 (original setting of step (c) above) from this setting. The result should be between 4.0 and 6.0 dB.

NOTE

Self-test of the AN/VPM-2 system tester has now been completed for the radar transmitter frequency selected. If another transmitter frequency is selected, a complete self-test of the system tester must be conducted for that frequency.

(g) Disconnect the flexible waveguide from SELF-TEST port and replace SELF TEST cover.

8-4. Radar Test

a. Preparation for Tests.

(1) With the radar system and vehicle power deenergized, disconnect the rotary joint of the antenna unit 1 by removing 4 screws, 4 flat washers, and 4 lock washers from the waveguide section as shown in figure 8-2.

(2) Push the waveguide section away from the rotary joint being careful not to destroy or loosen the rf seal located between the rotary joint and waveguide section. Connect 90 degree waveguide from accessory kit to W5 and connect W5 to rotary joint as shown in figures 8-2. and 8-3.

CAUTION

Ensure that the waveguide W5 is connected between the radar and AN/VPM-2 system tester for proper termination to prevent damage to equipment.

b. Preliminary Test

(1) Adjust APU for +28 to +29 Vdc.

(2) On distribution box (A1), set NORM-STATIC-TEST switch to STATIC.

(3) System control panel

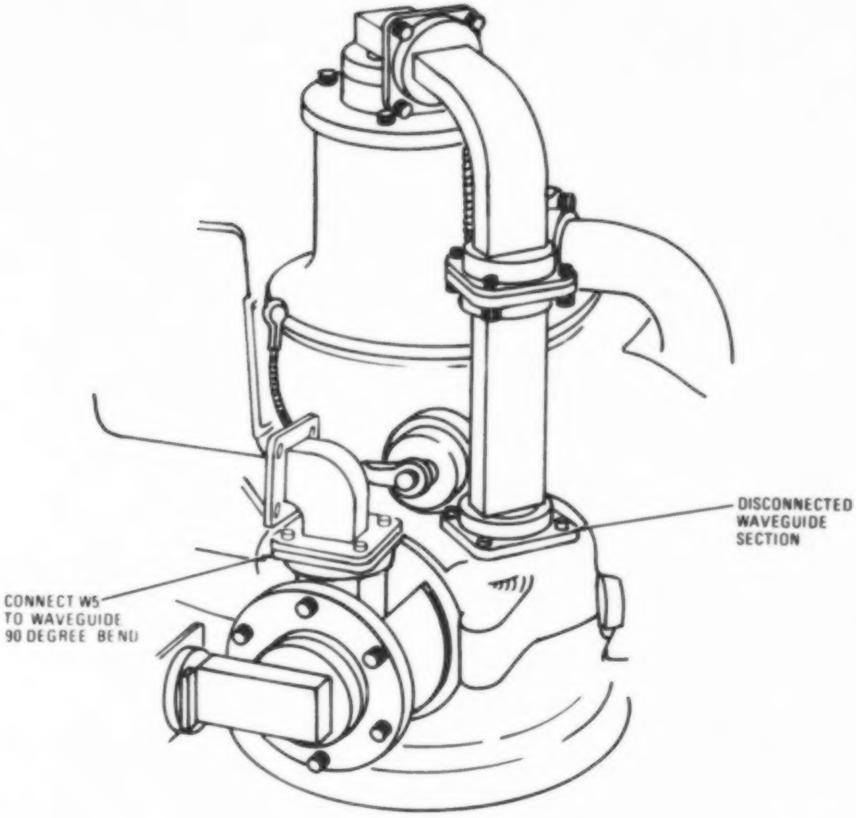
(a) SYSTEM POWER switch: OFF

(b) GUN POWER switch: OFF

(c) MODE switch: RADAR

(4) M61 sight: mechanically caged.

(5) Antenna MODE switch to STOW.


DISCONNECTED WAVEGUIDE SECTION
CONNECT W5 TO WAVEGUIDE 90 DEGREE BEND

AR925511

Figure 8-2. Antenna unit 1, rotary joint disconnection

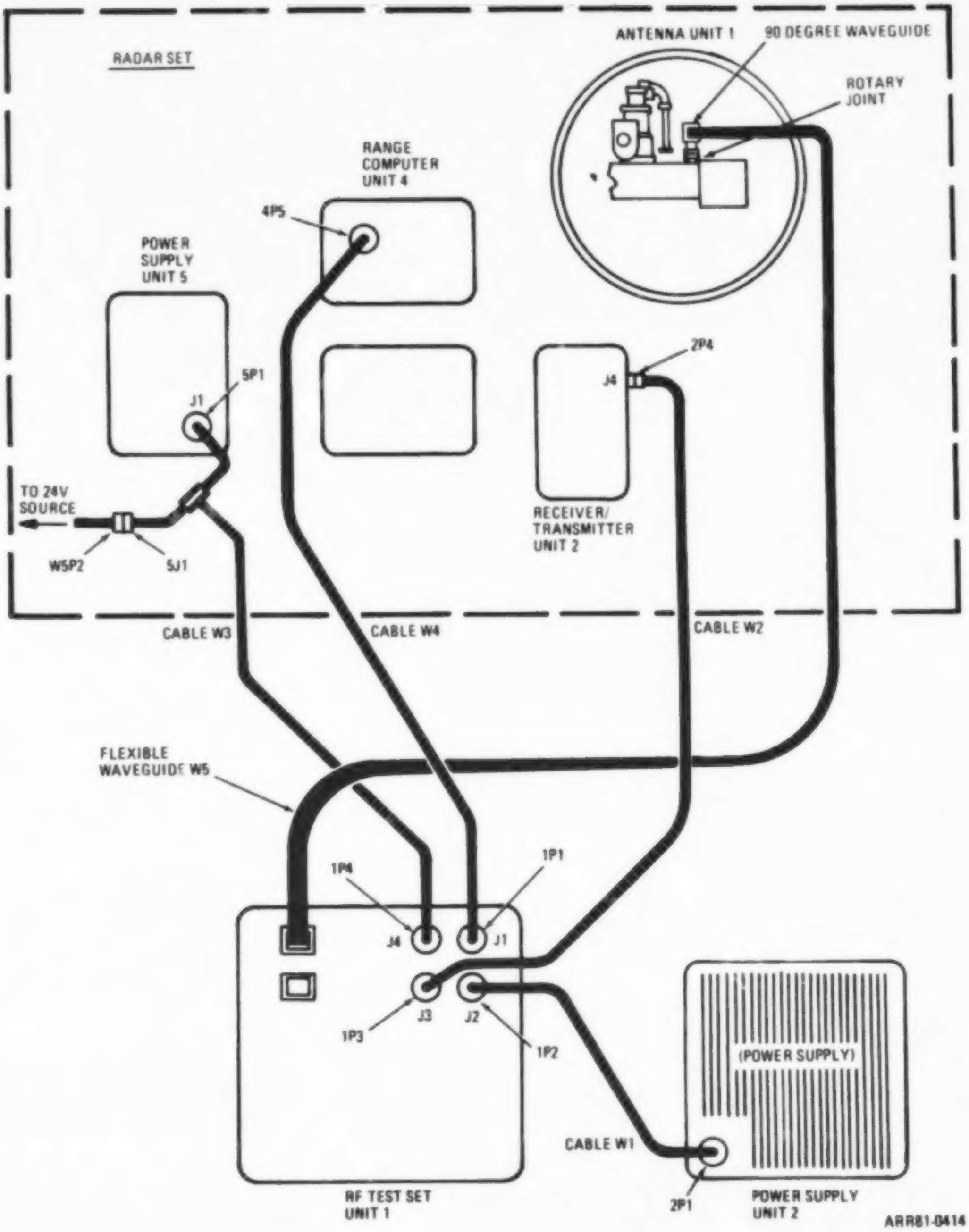

RADAR SET
ANTENNA UNIT 1
90 DEGREE WAVEGUIDE
ROTARY JOINT
RANGE COMPUTER UNIT 4
4P5
POWER SUPPLY UNIT 5
J1
5P1
TO 24V SOURCE
W5P2
5J1
J4
2P4
RECEIVER/ TRANSMITTER UNIT 2
CABLE W3
CABLE W4
CABLE W2
FLEXIBLE WAVEGUIDE W5
1P4
1P1
J4
J1
J3
J2
1P3
1P2
(POWER SUPPLY)
CABLE W1
RF TEST SET UNIT 1
2P1
POWER SUPPLY UNIT 2
ARR81-0414

Figure 8-3. AN/VPS-2 system test equipment setup

(6) System control panel SYSTEM POWER switch: ON

(7) On the radar set, unit 4, press the PRESS TO TEST switch and verify that MID RANGE CALIBRATION indicator lights brightly.

NOTE

Three seconds after the PRESS TO TEST switch is released, MID RANGE CALIBRATION indicator begins flashing at a once per second rate.

(8) After the READY WHEN LIT lamp illuminates, momentarily energize the radar set to the radiate power condition, to ensure radiate capability.

NOTE

If any of the preceding steps cannot be accomplished, the fault must be corrected before proceeding.

(9) Set AN/VPM-2 controls as follows:

Control	Position
FUNCTION SELECT	VOLTAGE
VOLTAGE SELECT	+24
RF LEVEL	20 dB
FREQ SELECT	Radar transmit frequency (Refer to Table 8-1)
MODE SELECT	RADAR
PHASE CONTROL	Mid range
CLUTTER	OFF
CLUTTER LEVEL	80 dB
RANGE SELECT	R3
TARGET LEVEL	100 dB
TARGET FREEZE	OFF
TARGET	OFF
POWER	ON

(10) Open cover of radar transmitter unit 2 and determine radar transmit frequency by adding 60 MHz to the frequency marked on solid state crystal of X-Band source (table 8-1).

(11) Pull the service interlock switch S3 to the maintenance position

(12) After READY WHEN LIT lamp on control panel illuminates, set the SERV RAD CONT switch, located on the inside of the the top cover of R/T unit 2, to ON.

CAUTION

Place SERV RAD CONT switch to OFF when not making measurements to prevent damage to equipment. Reestablish references on digital display when returning SERV RAD CONT switch to ON to continue testing.

(13) The digital display should indicate +24.00 ± 2.0 Vdc.

(14) Set the VOLTAGE SELECT to the following positions and observe the digital display.

VOLTAGE SELECT	Digital Display (Vdc)
+5	+5.0 ± 0.2
+15	+15.0 ± 0.3
-15	-15.0 ± 0.3
+28	+28.0 ± 0.6

(15) Ensure that the LOCK ON indicator is not illuminated and the SIGNAL CHANNEL meter indicates less than 1.5 Vdc.

c. Transmitter Peak Power Measurement Procedure.

(1) Set the FUNCTION SELECT switch on the AN/VPM-2 to R.F. INPUT.

(2) Adjust RF LEVEL control for a reading of +2.500 ± 0.050 Vdc on digital display. Record the RF LEVEL control setting.

(3) Determine the radar peak power by the following calculation: RF LEVEL control setting (step (2)) plus R. F. INPUT calibration factor on AN/VPM-2 calibration chart equals the radar peak transmitted power in dBm.

NOTE

Calculated peak transmitted power is +56 to+58 dBm minimum for self propelled and +54 to +56 dBm for towed vehicle.

(4) Refer to table 8-4 if this criteria cannot be obtained.

d. Maximum Clutter Check.

(1) Set the FUNCTION SELECT switch to RF MONITOR.

(2) Set the CLUTTER switch to ON

(3) Adjust the RF LEVEL control for a +2.500 ± 0.075 Vdc indication on the digital display.

(4) Slowly decrease (lower number on dial) the CLUTTER LEVEL dial to 5 dB. Ensure that the LOCK ON indicator is not illuminated.

NOTE

If the LOCK ON indicator is illuminated, perform the following adjustments in this order: threshold level adjustment paragraph 2-7 and IF amplifier video gain control adjustment paragraph 8-5.

(5) Set the CLUTTER LEVEL dial to 80 dB and the CLUTTER switch to OFF.

e. Minimum Discernible Signal (MDS)

(1) Set the TARGET switch to ON and the FUNCTION SELECT to RF MONITOR.

(2) Adjust the RF LEVEL control for a digital display indication of +2.500 ± 0.075 Vdc and maintain this indication for the remainder of this procedural step (e).

(3) Decrease (lower number on dial) the TARGET LEVEL control until the LOCK ON indicator illuminates. Record the TARGET LEVEL dial indication.

(4) Increase (higher number on dial) the TARGET LEVEL by 10.0 dB. The LOCK ON indicator should not illuminate after an approximate 3 second delay.

(5) Repeat steps (3) and (4) until reading obtained in step (3) is within 1.0 dB and record this reading. This is the radar system MDS.

NOTE

The calculated MDS acceptability criteria is 80 to 88 dBm. Refer to table 8-4.

(6) Set the TARGET switch to OFF and the TARGET LEVEL control to 100 dB.

f. Sub-clutter Visibility (SCV) Measurement Procedure

(1) Set the RANGE SELECT switch to R4.

(2) Connect the TPS shorting plug (part of accessory kit) to J6 of receiver unit 3.

(3) Set the FUNCTION SELECT switch to R.F. MONITOR.

(4) Adjust the RF LEVEL control to obtain a reading of 2.500 ± 0.075 Vdc on the digital display.

(5) Set the TARGET switch to ON.

(6) Adjust the TARGET LEVEL control until the LOCK ON indicator is illuminated.

(7) Decrease (lower number on dial) the TARGET LEVEL control setting by 5 dB.

(8) Set the TARGET FREEZE switch to ON. The LOCK ON indicator should stay illuminated.

(9) Set the CLUTTER switch to ON.

(10) Adjust the CLUTTER LEVEL control until the SIGNAL CHANNEL meter indicates a minimum of 1.5 volts.

(11) Adjust the PHASE CONTROL for a maximum signal indication on the SIGNAL CHANNEL meter.

(12) Set the TARGET switch to OFF, the TARGET FREEZE to OFF, the CLUTTER LEVEL control to 80 dB, TARGET LEVEL control to 100 dB. (LOCK ON light extinguishes.)

(13) Check the RF LEVEL control adjustment and maintain a reading of 2.500 ± 0.075 Vdc on the digital display for the remainder of this procedural step (f).

(14) Adjust the CLUTTER LEVEL control until the LOCK ON indicator is illuminated. Record the CLUTTER LEVEL dial number. (Light does not have to stay locked on.)

(15) Increase (higher number on dial) the CLUTTER LEVEL control setsing by 10.0 dB. The LOCK ON indicator should not be illuminated after an approximate 3-second delay.

(16) Carefully repeat steps (14 and 15) until a reading obtained in step (14) is within 1.0 dB.

(17) Record the CLUTTER LEVEL dial reading obtained in step (14). This is the lock on clutter power (no AGC).

(18) Determine the SCV by subtracting the lock on clutter power (no AGC) obtained in step (17) from the minimum discernible signal (MDS) obtained in e(5). The SCV acceptability criteria is 40 dB minimum. If the measured SCV does not meet this criteria, refer to table 8-4.

(19) Set the CLUTTER switch to OFF, the CLUTTER LEVEL control to 80 dB, the RANGE SELECT switch to R3 and the PHASE CONTROL to midrange.

(20) Disconnect the TPS shorting plug from J6 of the receiver unit 3 and return it to the accessory kit.

g. AGC Cut-in and Linearity Measurement

(1) Set the CLUTTER switch to ON.

(2) Set the FUNCTION SELECT switch to R.F. MONITOR. Adjust the RF LEVEL control and maintain a digital display indication of 2.500 ± 0.075 Vdc for the remainder of this procedural step (g).

(3) Decrease the CLUTTER LEVEL control setting slowly to 5 dB while observing that the LOCK ON indicator does not illuminate.

(4) Set the CLUTTER switch to OFF and the TARGET switch to ON.

(5) Adjust the TARGET LEVEL control until the LOCK ON indicator illuminates.

(6) Set the CLUTTER switch to ON. The LOCK ON indicator should not be illuminated after an approximate 3-second delay.

(7) Increase (higher number on dial) the CLUTTER LEVEL control setting until the LOCK ON indicator is illuminated.

(8) Decrease (lower number on dial) the CLUTTER LEVEL setting by 10.0 dB. The LOCK ON indicator should not be illuminated after an approximate 3-second delay.

(9) Increase (higher number on dial) the CLUTTER LEVEL control until the LOCK ON indicator is illuminated. Record the CLUTTER LEVEL dial setting.

(10) Carefully repeat steps (8) and (9) until readings obtained in step (9) are within 1.0 dB.

(11) Record the CLUTTER LEVEL dial reading obtained in step (9). This is the LOCK ON CLUTTER POWER (with AGC).

(12) Determine the AGC cut-in by subtracting the lock on clutter power reading obtained in step (9) from the minimum discernible signal (MDS) obtained in e(5). The AGC cut-in acceptability criteria is 38 to 40 dB. If the measured AGC cut-in does not meet this criteria, refer to table 8-4.

(13) Decrease (lower number on dial) the CLUTTER LEVEL control setting by 10 dB and record the dial reading. The LOCK ON indicator should not be illuminated after an approximate 3 second delay.

(14) Decrease (lower number on dial) the TARGET LEVEL control setting until the LOCK ON indicator illuminates. Record the TARGET LEVEL dial reading.

(15) Repeat steps (13) and (14) in 10 dB increments. The last CLUTTER LEVEL increment may be less than 10 dB. Record each increment.

(16) Determine AGC linearity by subtracting each lower TARGET LEVEL reading from the one immediately before it with the exception of the last reading. The tolerances are:

10 dB	9.0 to 14.0 dBm
20 dB	9.0 to 16.0 dBm
30 dB	9.0 to 18.0 dBm

If the measured AGC linearity does not meet this criteria, refer to table 8-4.

(17) Set the CLUTTER switch to OFF, the TARGET switch to OFF, CLUTTER LEVEL to 80, and the TARGET LEVEL control to 100.

h. Range and Range Rate Measurements

(1) Ensure that the TARGET and CLUTTER switches are in the OFF position.

(2) Set the FUNCTION SELECT switch to RANGE RATE REF (+). Read and record the indication on the digital display. The range rate reference (+) acceptability criteria is +10.00 ± 0.2 Vdc. If the range rate reference (+) measurement does not meet this criteria, refer to table 8-4.

(3) Set the FUNCTION SELECT switch to RANGE REF.

(4) Read and record the range reference voltage indicated on the digital display. The range reference acceptablity criteria is +20.00 ± 0.2 Vdc. If the range reference measurement does not meet this criteria, refer to table 8-4.

(5) Set the FUNCTION SELECT switch to RANGE RATE.

(6) Read and record the indication on the digital display. The range rate acceptability criteria is -6.3 to -6.5 Vdc.

(7) Set the FUNCTION SELECT switch to RANGE RATE REF (-).

(8) Read and record the indication on the digital display. The range rate reference (-) acceptability criteria is -10.00 ± 0.1 Vdc. If the range rate reference (-) measurement does not meet this criteria, refer to table 8-4.

i. Range Accuracy Measurement Procedure

(1) Set the FUNCTION SELECT switch to RF MONITOR and the RANGE SELECT switch to R1.

(2) Adjust the RF LEVEL control to obtain a reading of +2.500 ± 0.075 Vdc on the digital display.

(3) Set the TARGET switch to ON.

(4) Adjust the TARGET LEVEL control until the LOCK ON indicator illuminates.

(5) Decrease (lower number on dial) the TARGET LEVEL control setting by 10 dB.

(6) Set the FUNCTION SELECT switch to RANGE.

(7) Adjust the PHASE CONTROL for maximum stable indication on the digital display.

(8) Read and record the range voltage indicated on the digital display.

NOTE

Allow 3 seconds for the radar to re-acquire the target signal each time the RANGE SELECT switch is changed.

(9) Set the RANGE SELECT switch to R2, R3 and R4 and repeat steps (7) and (8).

(10) Determine the range of the radar set using the following procedure

(a) Using table 8-2, locate the voltage (step i.(8)) for R1 and record the corresponding range in meters.

(b) Using Table 8-3, locate the range reference voltage (step h.(4)) and record the correction for R1.

(c) The total of the two preceding steps is the corrected range of the radar in the R1 position. Record this figure.

(d) Record the AN/VPM-2 system tester calibration data figure for R1.

(e) Determine the range error by finding the difference between the AN/VPM-2 system tester calibration card data and the corrected range.

(f) Repeat steps (a) through (e) for the remaining range positions (R2, R3, R4).

(g) The difference between the calculated range and the value indicated on the AN/VPM-2 system tester calibration card shall be within the following tolerances:

R1	±	15 meters
R2	±	15 meters
R3	±	16 meters
R4	±	47 meters

NOTE

If the radar is not within these tolerances and the errors are all in the same direction, add or remove T tap connections in the range rate counter B (4A12) of the computer unit 4 to obtain the correct indications (refer to Figure 8-4). Figure 8-4 shows all taps installed between E1 through E8 and E9 through E16.

When the radar range is higher than the AN/VPM-2 system tester calibration card number the range rate counter B (4A12) taps must be removed. When radar range is below tester range, taps must be added. Each tap changes (increases or decreases) all range values by 20 meters.

(h) Repeat range accuracy measurement procedure if range correction taps were added or removed.

(11) Set the TARGET switch to OFF.

(12) Radar tests are now completed. Take the radar out of radiate condition.

(13) Turn the AN/VPM-2 POWER switch to OFF.

(14) Turn the System POWER switch to OFF.

(15) Disconnect AN/VPM-2 cables from radar and restore radar to original configuration. Make sure that waveguide rotary joint is connected.

Table 8-2. Meters to volts conversion chart

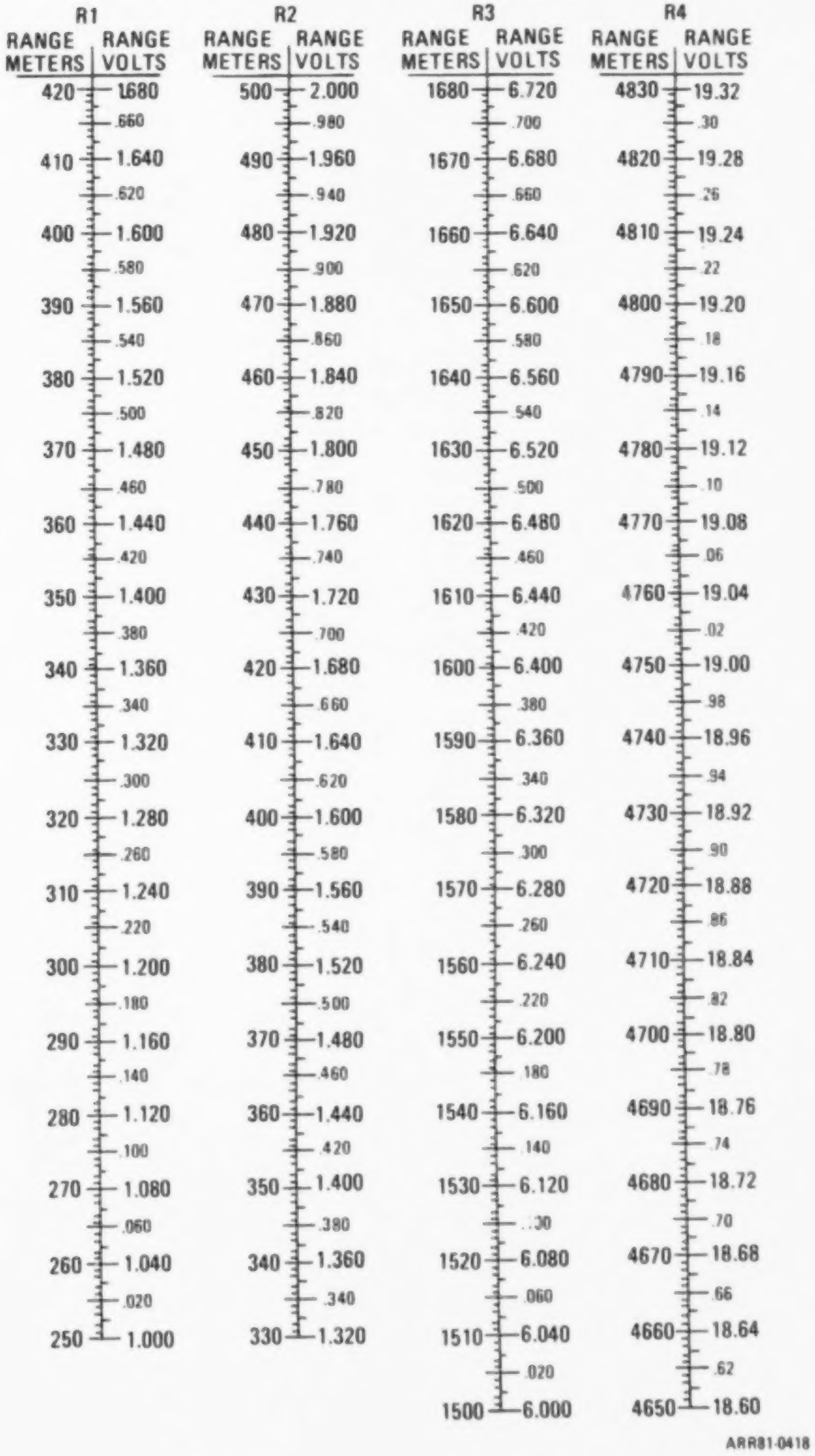


Table 8-3. Range Reference Correction

Range Reference Voltage	R1	R2	R3	R4
20.20	-3	-4	-16	-47
20.19	-3	-4	-15	-45
20.18	-3	-4	-14	-43
20.17	-3	-3	-14	-40
20.16	-2	-3	-13	-38
20.15	-2	-3	-12	-35
20.14	-2	-3	-11	-33
20.13	-2	-3	-10	-31
20.12	-2	-2	-9	-22
20.11	-2	-2	-9	-26
20.10	-2	-2	-8	-24
20.09	-1	-2	-7	-21
20.08	-1	-2	-6	-18
20.07	-1	-1	-6	-17
20.06	-1	-1	-5	-14
20.05	-1	-1	-4	-12
20.04	-1	-1	-3	-9
20.03	0	-1	-2	-7
20.02	0	0	-2	-5
20.01	0	0	-1	-2
20.00	0	0	0	0
19.99	0	0	+1	+2
19.98	0	0	+2	+5
19.97	0	+1	+2	+7
19.96	+1	+1	+3	+9
19.95	+1	+1	+4	+12
19.94	+1	+1	+5	+14
19.93	+1	+1	+6	+17
19.92	+1	+2	+6	+19
19.91	+1	+2	+7	+21
19.90	+2	+2	+8	+24
19.89	+2	+2	+9	+26
19.88	+2	+2	+9	+28
19.87	+2	+3	+10	+31
19.86	+2	+3	+11	+33
19.85	+2	+3	+12	+35
19.84	+2	+3	+13	+38
19.83	+3	+3	+13	+40
19.82	+3	+4	+14	+43
19.81	+3	+4	+15	+45
19.80	+3	+4	+16	+47

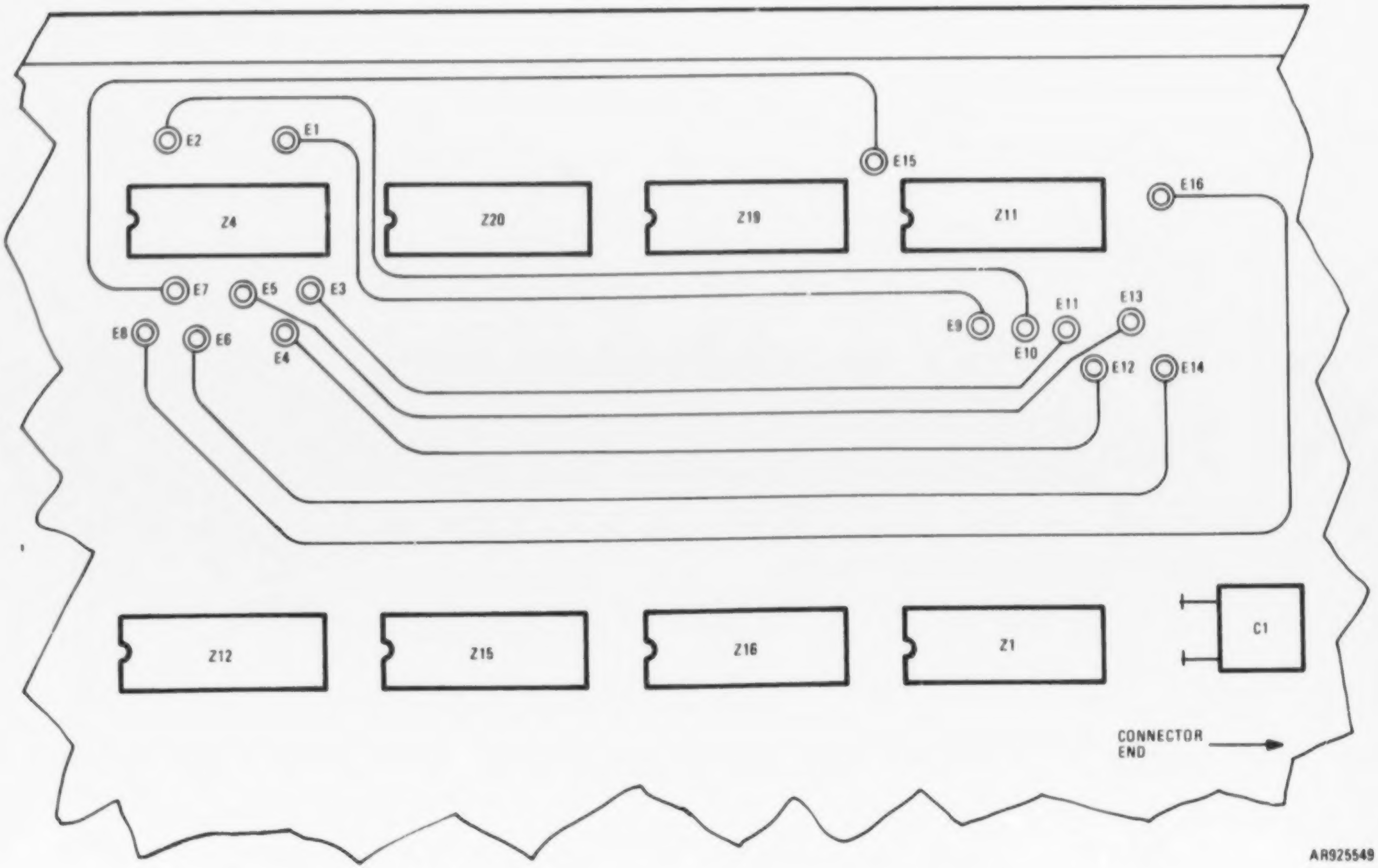

E2
E1
E15
E16
Z4
Z20
Z19
Z11
E7
E5
E3
E8
E6
E4
E9
E10
E11
E13
E12
E14
Z12
Z15
Z16
Z1
C1
CONNECTOR END
AR925549

Figure 8-4. Range rate counter B 4A12, T tap connections

8-5. IF Amplifier 3A1 Video Gain Control Adjustment.

NOTE

> The threshold level adjustment, paragraph 2-7, should be performed before this adjustment is made.

a. Set the CLUTTER switch to OFF. Set TARGET switch to ON.

b. Adjust the TARGET LEVEL control until the LOCK ON indicator is illuminated. Record the setting.

c. Make the following calculation:

Target level obtained in step b. (MDS) minus 38 = clutter level dial setting .

d. Set the CLUTTER switch to ON.

e. Set the CLUTTER LEVEL to clutter level determined in step c. Remove the receiver unit 3 from its case and remove the screw cap covering the IF amplifier 3A1 GAIN ADJUST control.

f. Using a jewelers screwdriver, slowly adjust the IF amplifier 3A1 GAIN ADJUST control clockwise until the LOCK ON indicator is not illuminated.

g. Slowly rotate the IF amplifier 3A1 GAIN ADJUST counterclockwise until the LOCK ON indicator illuminates.

h. Recheck the AGC cut-in point by:

(a) Increasing the CLUTTER LEVEL until LOCK ON indicator is not illuminated.

(b) Decreasing the CLUTTER LEVEL until LOCK ON indicator illuminates.

(c) Making the following calculation:

MDS level minus Clutter Power Level = AGC cut-in level.

The AGC cut-in acceptability criteria is 38 to 40 dB.

i Replace the IF amplifier 3A1 screw cap and replace unit 3 in its case.

8-6. Troubleshooting. Troubleshooting procedures for the overall radar are based on symptoms obtained while performing the test procedures contained in paragraphs 8-4 and 8-5. Troubleshooting table 8-4 lists the symptoms and provides the probable causes and corrective actions associated with each symptom.

Table 8-4. Overall Radar Troubleshooting

Problem	Probable cause	Corrective action
1. No MID RANGE CAL	See corrective action	Refer to figure 2-3
2. Radar will not radiate	See corrective action	Refer to figure 2-3
3. Radar power output low	a. Klystron not tuned b. Defective transmitter	a. Refer to paragraph 4-4 b. Refer to figure 2-4
Radar power output high	See corrective action	Adjust waveguide attenuator 2A1AT1
4. Radar fails maximum clutter check	a. Threshold level not adjusted b. Power source or grounding noise	a. Refer to paragraph 2-7 b. Repeat maximum clutter check using battery power alone. If successful, check systems grounds.
	c. IF video gain not adjusted d. AGC of receiver defective	c. Refer to paragraph 8-5 d. Replace AGC unit 3A2 or receiver unit 3
5. Radar MDS above 88	Threshold level not adjusted	Refer to paragraph 2-7
6. Radar MDS below 80	See corrective action	Replace receiver unit 3 Replace microwave assembly 2A1
7. SCV less than 40	a. Threshold level not adjusted b. Defective X band oscillator in unit 2 c. Improper system grounding	a. Refer to paragraph 2-7 b. Replace X band oscillator 2A1A1 c. Repeat SCV test with radar operating on battery power alone. If successful, check system grounding connections.
8. AGC cut-in between 40 and 42	See corrective action	If radar passes maximum clutter check, adjustment not necessary.
9. AGC cut-in below 38 or above 42	See corrective action	Refer to paragraph 8-5
10. Other AGC cut-in failures	Defective receiver subassembly	Replace IF amplifier 3A1, AGC unit 3A2
11. AGC linearity out of tolerance	See corrective action	Replace AGC unit 3A2

Table 8-4. Overall Radar Troubleshooting - Continued

Problem	Probable cause	Corrective action
12. Radar fails range rate reference (+) test	See corrective action	Adjust range rate reference voltage (4A17-R4) for 20.00 volts. Replace 4A17 if range rate reference (+) remains out of tolerance.
13. Radar fails range reference test	See corrective action	Adjust 4A17-R4 for 20.00 volts. Replace 4A17 then 4A16 if range reference voltage remains out of tolerance.
14. Radar fails range rate test	See corrective action	Replace 4A17 or 4A12
15. Radar fails range rate reference (-) test	See corrective action	Replace 4A17
16. Radar fails range accuracy test	See corrective action	If R1, R2, R3, and R4 errors are in the same direction, add or remove jumper taps on range rate counter B card (4A12). Adding one jumper to card 4A12 increases the radar range by 20 meters. Removing one jumper decreases the range by 20 meters. If radar is out of tolerance on both upper and lower limits, rerun range accuracy test and recheck calculations. If condition remains, replace card 4A16. If condition persists, replace card 4A9.

CHAPTER 9

ANTENNA UNIT 1 ALIGNMENT

9-1. General. Alignment of the radar antenna unit 1 electrical and optical axes is performed by using the antenna alignment test set. This procedure applies to both the M163A1 and M167A1 vehicles.

9-2. Antenna Unit 1 Alignment.

a. Select a level, unobstructed area for alignment.

b. Position and connect the equipment as shown in figure 9-1.

c. Adjust the target height to position the detector approximately 8-feet above ground level for the M163A1 vehicle and 5-feet above ground level for the M167A1 vehicle.

NOTE

The distance between the white marker bands located near each end of the radar beam detector cable is 1,000 inches (83.3 feet). Use these markers to accurately locate the target as shown in figure 9-1.

d. Set the GUN POWER switch to OFF.

e. Check that the cannon is clear. To clear the cannon, hold the BRAKE-CLEAR and BRAKE switch to CLEAR and BRAKE and rotate the barrels two complete revolutions. Remove any rounds remaining in the case chute.

f. Remove the arming connector from the firing interrupter on the M167A1 and from the distribution box on the M163A1.

g. Set the SYSTEM POWER switch to ON and the MODE switch to RADAR.

h. Set the system distribution box NORM-STATIC-TEST switch to STATIC.

i. Set the stow control MODE switch to NORMAL.

j. Set the stow control MAINT switch to ON.

k. Pull out the TRAV and ELEV circuit breakers on the power supply unit 5.

l. Inspect the convex surface of the reflector 1A1. Affix an antenna corrections data decal as shown in figure 9-2. Remove and discard any other antenna corrections data decals from the reflector 1A1.

m. Open the receiver/transmitter (R/T) unit 2 cover and set the interlock switch S3 to ON.

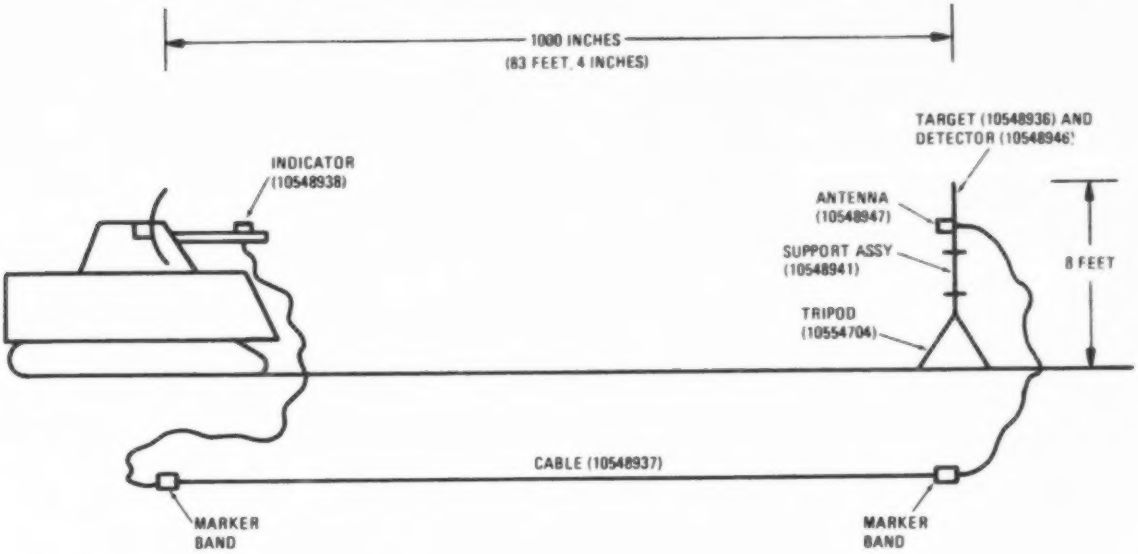
n. Install the boresight telescope in the mounting bracket located on the reflector 1A1. Wait until the READY WHEN LIT indicator illuminates before proceeding with the test.

WARNING

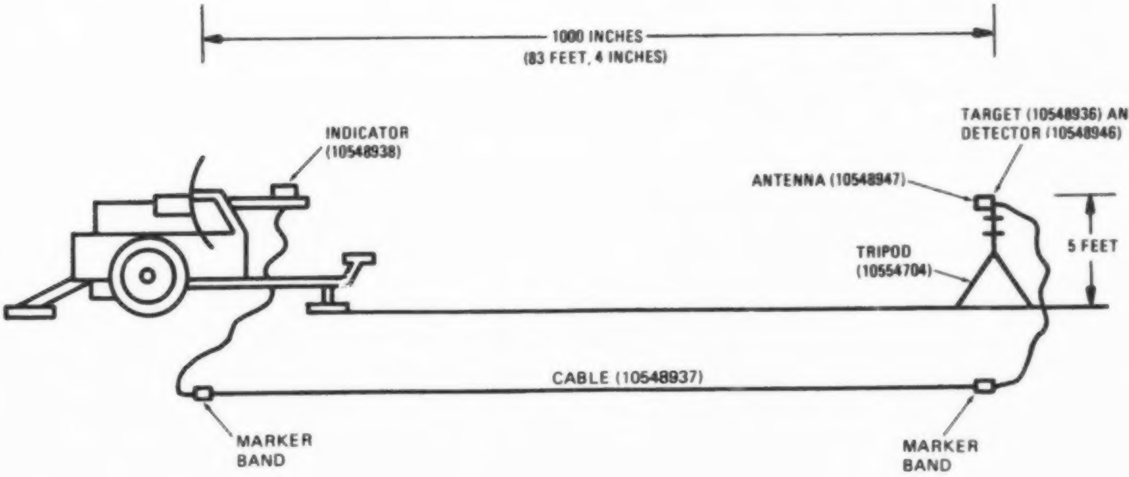
A potential radiation hazard exists when the radar is energized and transmitting. Stay at least three feet away from the center of the antenna when the radar is transmitting.

NOTE

The radar field of view between the antenna and target and behind the target must be free of moving and stationary objects for a distance of at least 300 meters.


1000 INCHES
(83 FEET, 4 INCHES)
TARGET (10548936) AND
DETECTOR (10548946)
INDICATOR
(10548938)
ANTENNA
(10548947)
SUPPORT ASSY
(10548941)
8 FEET
TRIPOD
(10554704)
CABLE (10548937)
MARKER
BAND
MARKER
BAND

A. SELF-PROPELLED M163A1 WEAPON SYSTEM


1000 INCHES
(83 FEET, 4 INCHES)
TARGET (10548936) AND
DETECTOR (10548946)
INDICATOR
(10548938)
ANTENNA (10548947)
5 FEET
TRIPOD
(10554704)
CABLE (10548937)
MARKER
BAND
MARKER
BAND

B. TOWED M167A1 WEAPON SYSTEM

AR925550

Figure 9-1. Antenna unit 1, alignment equipment setup

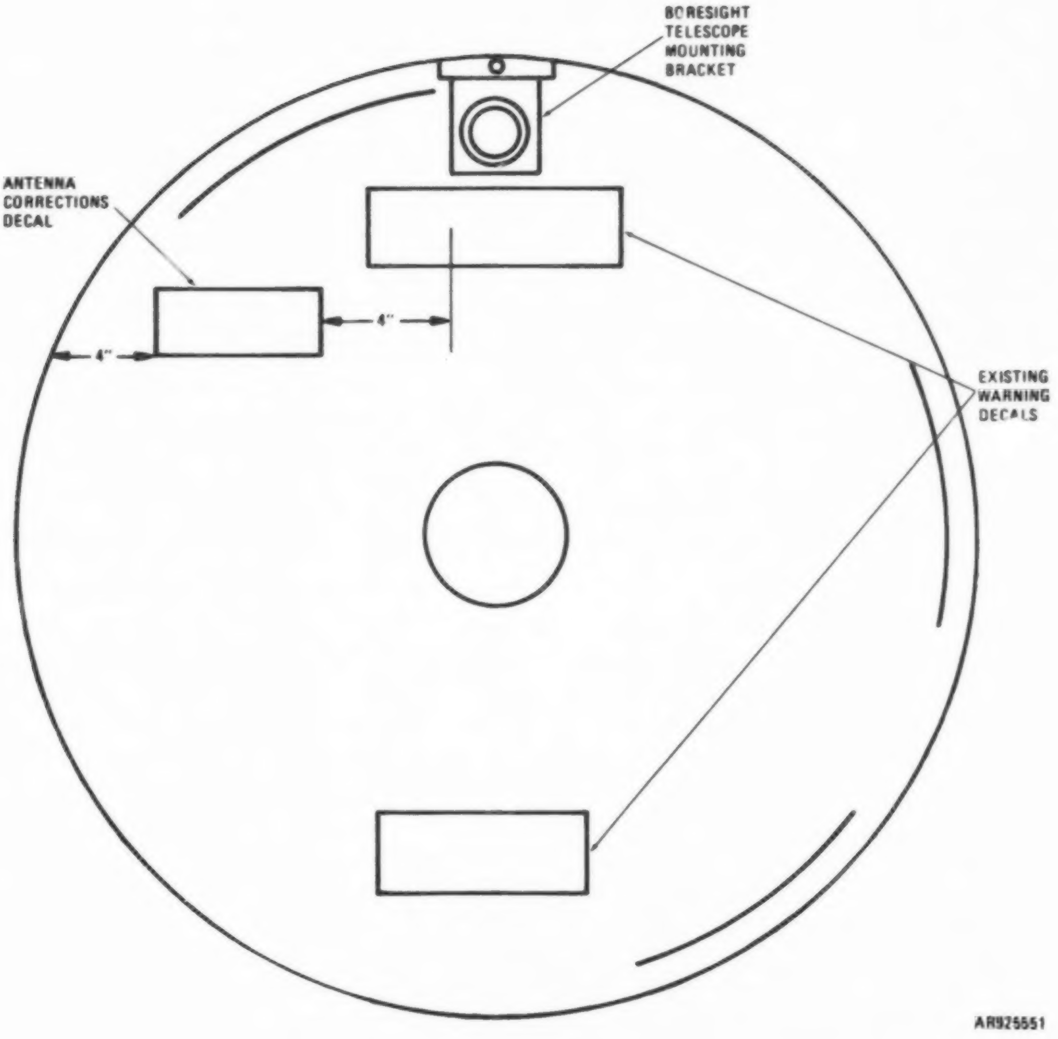

BORESIGHT
TELESCOPE
MOUNTING
BRACKET
ANTENNA
CORRECTIONS
DECAL
4"
4"
EXISTING
WARNING
DECALS
AR925551

Figure 9-2. Antenna unit 1, corrections data decal location

o. Direct the antenna toward the target and on unit 2, set the SERV RAD CONT switch to ON.

p. Set the sensitivity switch on the antenna alignment indicator to 1.

q. Orient the antenna in azimuth and elevation by placing one hand on the counterweight and the other on the traverse drive 1A3 to produce a maximum upscale deflection on the meter indicator. Keep the antenna in this position.

CAUTION

Do not apply pressure to the waveguides while adjusting the antenna due to the possibility of damaging the waveguides.

r. Set the SENSITIVITY switch to the detent that produces maximum meter deflection.

s. Carefully refine the orientation of the antenna by moving the antenna in azimuth and elevation to produce a maximum upscale deflection on the indicator. Keep the antenna in this position.

t. Sight through the borescope and record the displacement of the boresight telescope cross hairs from the target cross. Refer to figure 9-3.

u. If the telescope cross hairs are displaced more than 20 mils from the target cross in either azimuth or elevation, replace the antenna reflector 1A1 and/or feedhorn and repeat the entire procedure.

v. If the displacement is 20 mils or less, record the amounts and directions of displacement.

EXAMPLE

Assume figure 9-3 is the sighting in step t above. The cross hair of the boresight telescope is displaced 10 mils below the target cross. Record this indication. The vertical cross hair is displaced eight mils to the left of target cross. Record this indication. Move the antenna for a zero indication on the meter. Repeat step s. and t. four times and record each indication. Determine the median average for horizontal cross hair displacement by arranging the 5 indications in ascending order, select the third (middle) indication and enter this on the antenna corrections decal. Determine and enter the median average indication for the vertical cross hair displacement on the decal. Refer to figure 9-4.

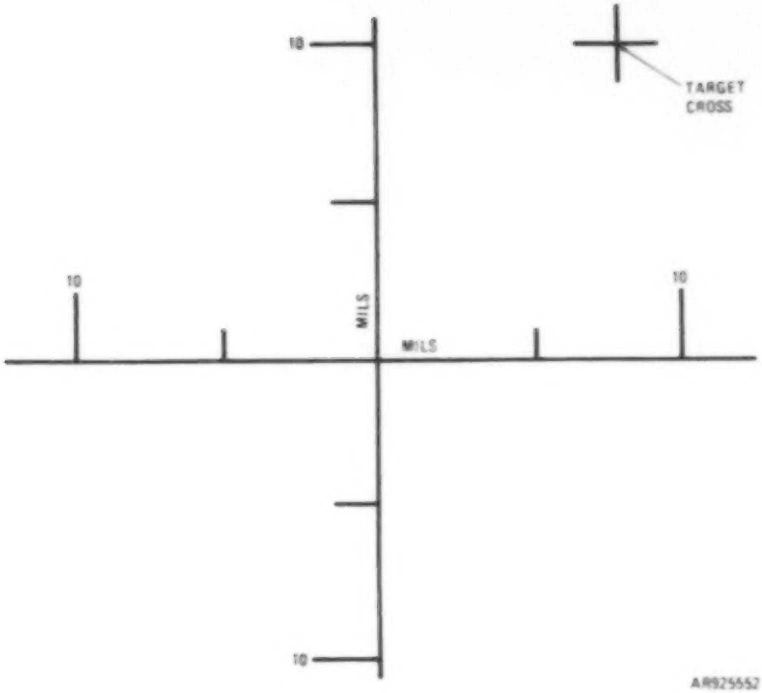
w. Set the SERV RAD CONT switch to OFF and the SYSTEM POWER switch to OFF.

x. Remove the boresight telescope from the antenna reflector 1A1.

y. Reinstall the arming connector to the firing interrupter for the M167A1 and to the distribution box in the M163A1.

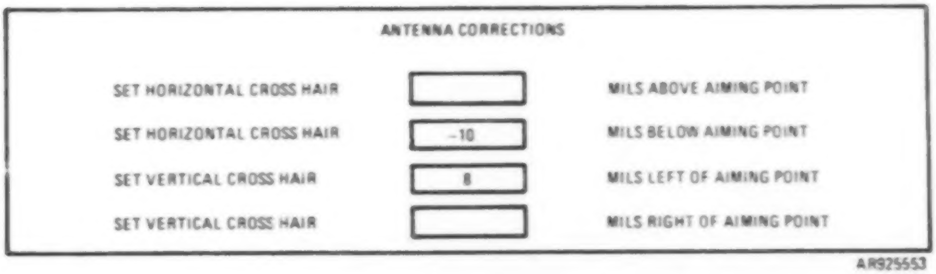
z. Close the R/T unit 2 cover.

aa. Push the TRAV and ELEV circuit breakers in on the power supply unit 5.



AR925552

Figure 9-3. Sample target sighting



ANTENNA CORRECTIONS

SET HORIZONTAL CROSS HAIR		MILS ABOVE AIMING POINT
SET HORIZONTAL CROSS HAIR	-10	MILS BELOW AIMING POINT
SET VERTICAL CROSS HAIR	8	MILS LEFT OF AIMING POINT
SET VERTICAL CROSS HAIR		MILS RIGHT OF AIMING POINT

AR925553

Figure 9-4. Sample antenna corrections label

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BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO	
2-25	2-28			Recommend that the installatior antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure the the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER
SSG I. M. DeSpiritof 999-1776

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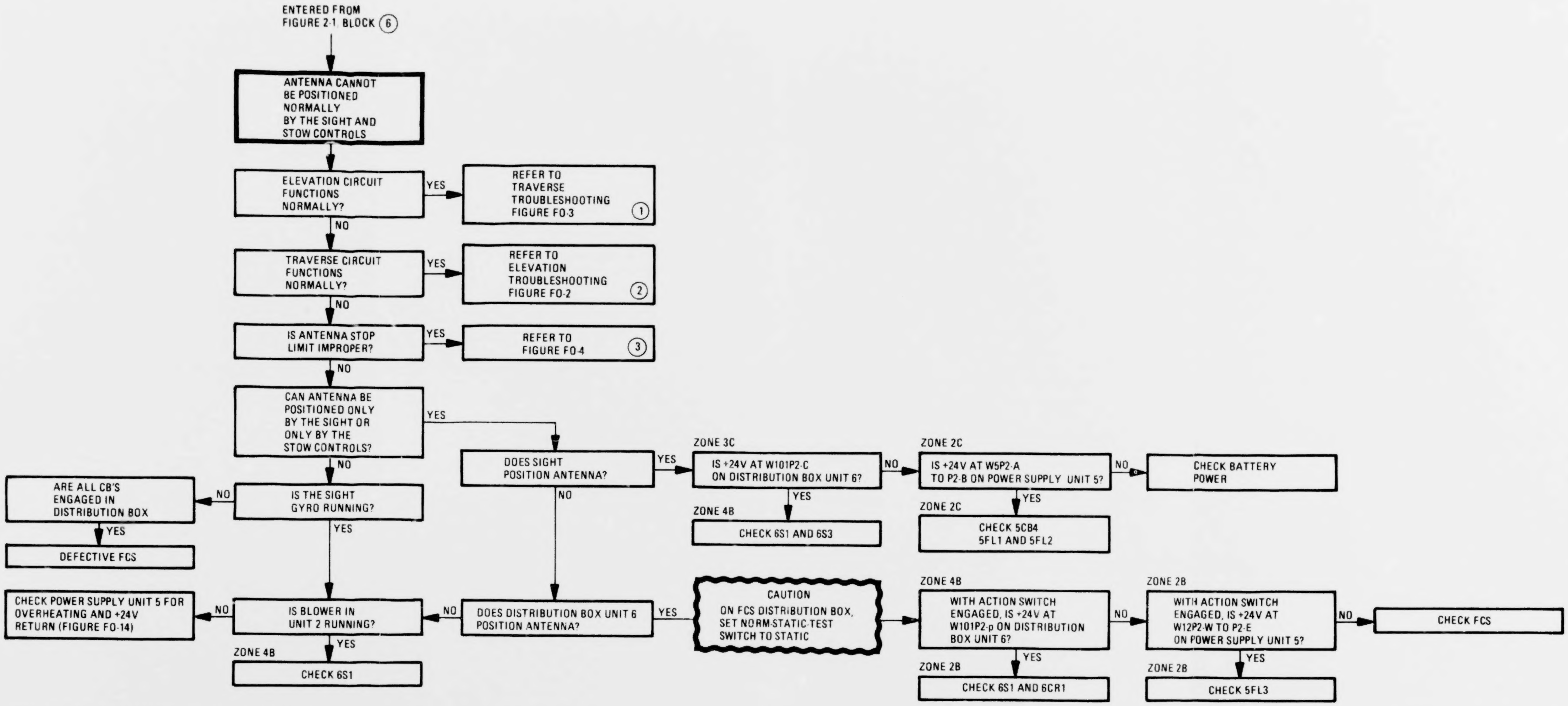
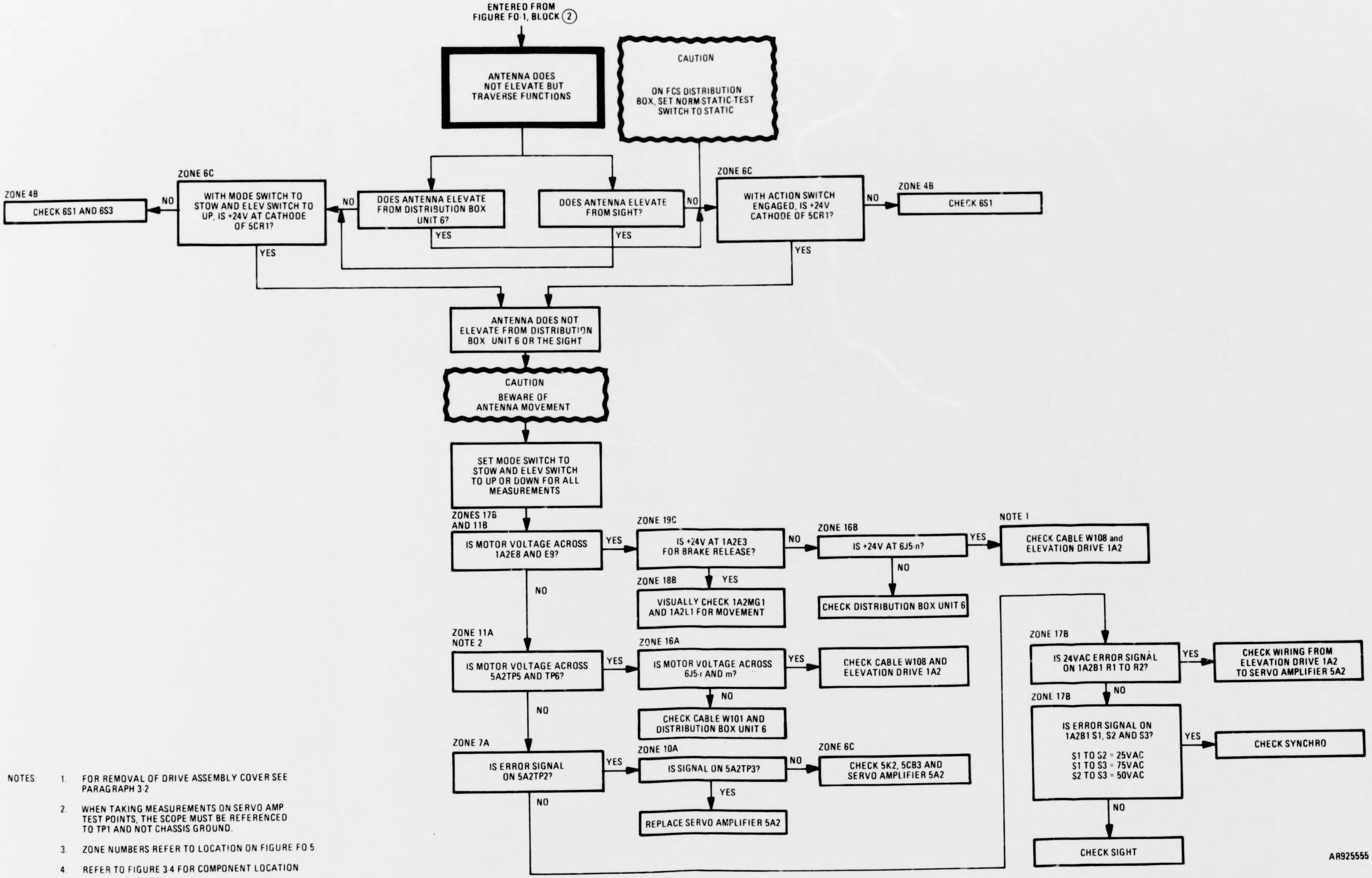

ENTERED FROM FIGURE 2-1, BLOCK ⑥
ANTENNA CANNOT BE POSITIONED NORMALLY BY THE SIGHT AND STOW CONTROLS
ELEVATION CIRCUIT FUNCTIONS NORMALLY?
YES
REFER TO TRAVERSE TROUBLESHOOTING FIGURE FO-3 ①
NO
TRAVERSE CIRCUIT FUNCTIONS NORMALLY?
YES
REFER TO ELEVATION TROUBLESHOOTING FIGURE FO-2 ②
NO
IS ANTENNA STOP LIMIT IMPROPER?
YES
REFER TO FIGURE FO-4 ③
NO
CAN ANTENNA BE POSITIONED ONLY BY THE SIGHT OR ONLY BY THE STOW CONTROLS?
YES
DOES SIGHT POSITION ANTENNA?
YES
ZONE 3C
IS +24V AT W101P2-C ON DISTRIBUTION BOX UNIT 6?
NO
ZONE 2C
IS +24V AT W5P2-A TO P2-B ON POWER SUPPLY UNIT 5?
NO
CHECK BATTERY POWER
YES
ZONE 2C
CHECK 5CB4 5FL1 AND 5FL2
YES
ZONE 4B
CHECK 6S1 AND 6S3
NO
NO
IS THE SIGHT GYRO RUNNING?
NO
ARE ALL CB'S ENGAGED IN DISTRIBUTION BOX
YES
DEFECTIVE FCS
YES
IS BLOWER IN UNIT 2 RUNNING?
NO
CHECK POWER SUPPLY UNIT 5 FOR OVERHEATING AND +24V RETURN (FIGURE FO-14)
YES
ZONE 4B
CHECK 6S1
NO
DOES DISTRIBUTION BOX UNIT 6 POSITION ANTENNA?
YES
CAUTION
ON FCS DISTRIBUTION BOX, SET NORM-STATIC-TEST SWITCH TO STATIC
ZONE 4B
WITH ACTION SWITCH ENGAGED, IS +24V AT W101P2-p ON DISTRIBUTION BOX UNIT 6?
YES
ZONE 2B
CHECK 6S1 AND 6CR1
NO
ZONE 2B
WITH ACTION SWITCH ENGAGED, IS +24V AT W12P2-W TO P2-E ON POWER SUPPLY UNIT 5?
YES
ZONE 2B
CHECK 5FL3
NO
CHECK FCS

NOTE: ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-5.

AR925554

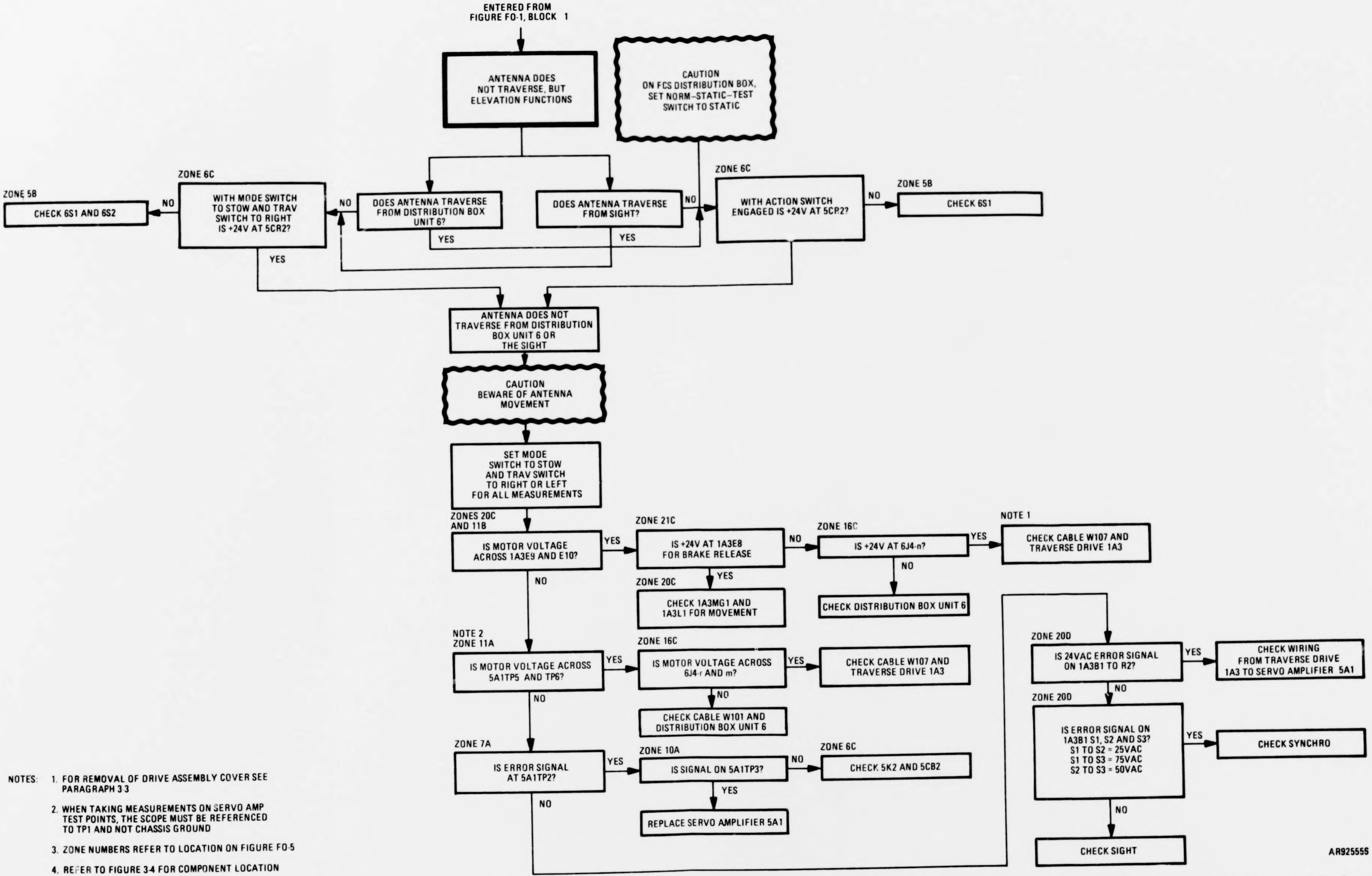
Figure FO-1. Antenna unit 1, fault localization diagram


ENTERED FROM
FIGURE FO-1, BLOCK ②
ANTENNA DOES NOT ELEVATE BUT TRAVERSE FUNCTIONS
CAUTION
ON FCS DISTRIBUTION BOX, SET NORM-STATIC-TEST SWITCH TO STATIC
ZONE 6C
WITH MODE SWITCH TO STOW AND ELEV SWITCH TO UP, IS +24V AT CATHODE OF 5CR1?
NO
ZONE 4B
CHECK 6S1 AND 6S3
NO
DOES ANTENNA ELEVATE FROM DISTRIBUTION BOX UNIT 6?
YES
DOES ANTENNA ELEVATE FROM SIGHT?
YES
NO
ZONE 6C
WITH ACTION SWITCH ENGAGED, IS +24V CATHODE OF 5CR1?
NO
ZONE 4B
CHECK 6S1
YES
YES
ANTENNA DOES NOT ELEVATE FROM DISTRIBUTION BOX UNIT 6 OR THE SIGHT
CAUTION
BEWARE OF ANTENNA MOVEMENT
SET MODE SWITCH TO STOW AND ELEV SWITCH TO UP OR DOWN FOR ALL MEASUREMENTS
ZONES 17B AND 11B
IS MOTOR VOLTAGE ACROSS 1A2E8 AND E9?
YES
ZONE 19C
IS +24V AT 1A2E3 FOR BRAKE RELEASE?
NO
ZONE 16B
IS +24V AT 6J5-n?
YES
NOTE 1
CHECK CABLE W108 and ELEVATION DRIVE 1A2
NO
CHECK DISTRIBUTION BOX UNIT 6
ZONE 18B
YES
VISUALLY CHECK 1A2MG1 AND 1A2L1 FOR MOVEMENT
NO
ZONE 11A
NOTE 2
IS MOTOR VOLTAGE ACROSS 5A2TP5 AND TP6?
YES
ZONE 16A
IS MOTOR VOLTAGE ACROSS 6J5-r AND m?
YES
CHECK CABLE W108 AND ELEVATION DRIVE 1A2
NO
CHECK CABLE W101 AND DISTRIBUTION BOX UNIT 6
NO
ZONE 7A
IS ERROR SIGNAL ON 5A2TP2?
YES
ZONE 10A
IS SIGNAL ON 5A2TP3?
NO
ZONE 6C
CHECK 5K2, 5CB3 AND SERVO AMPLIFIER 5A2
YES
REPLACE SERVO AMPLIFIER 5A2
NO
ZONE 17B
IS 24VAC ERROR SIGNAL ON 1A2B1 R1 TO R2?
YES
CHECK WIRING FROM ELEVATION DRIVE 1A2 TO SERVO AMPLIFIER 5A2
NO
ZONE 17B
IS ERROR SIGNAL ON 1A2B1 S1, S2 AND S3?
S1 TO S2 = 25VAC
S1 TO S3 = 75VAC
S2 TO S3 = 50VAC
YES
CHECK SYNCHRO
NO
CHECK SIGHT
AR925555

NOTES

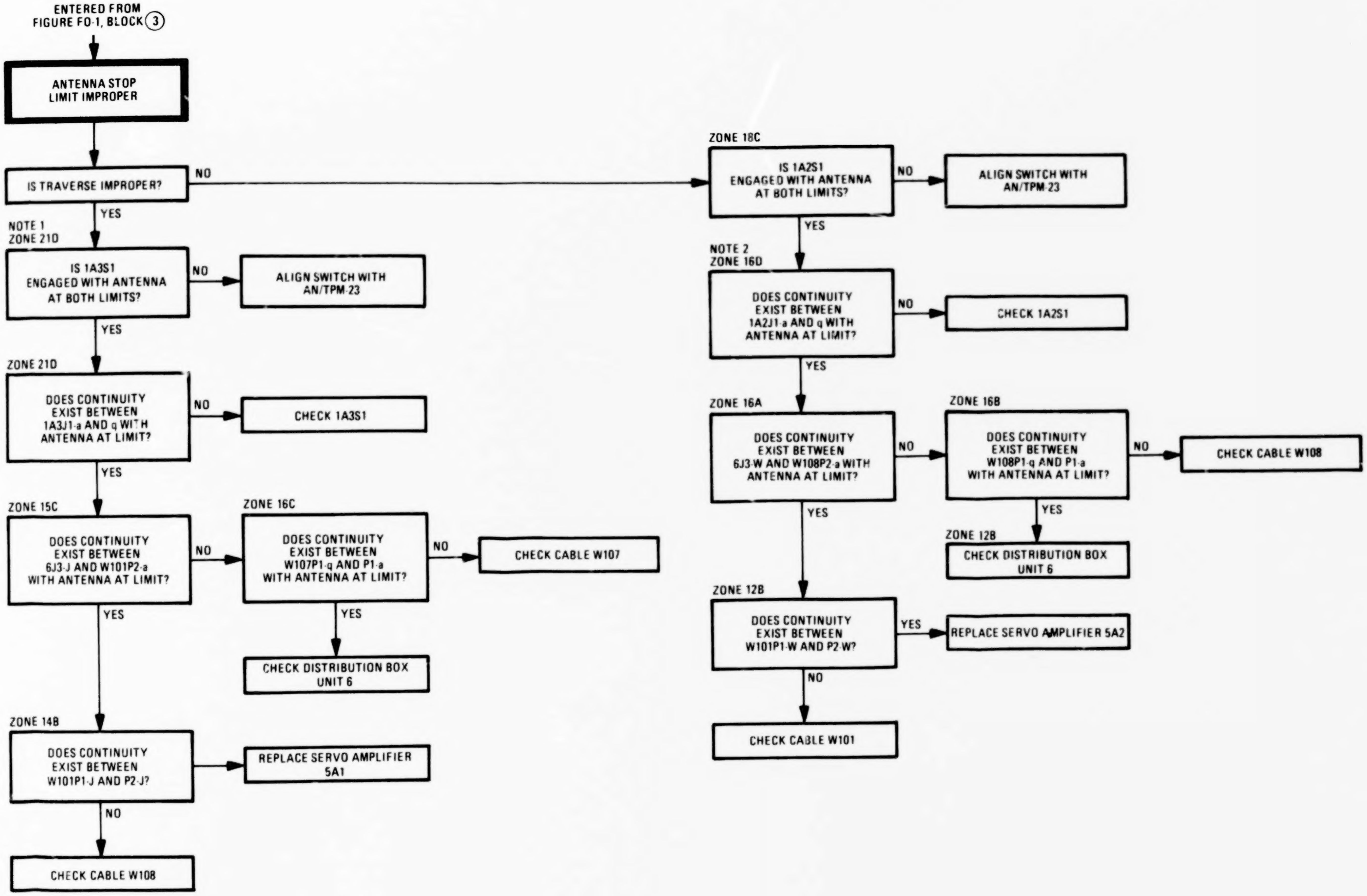
1. FOR REMOVAL OF DRIVE ASSEMBLY COVER SEE PARAGRAPH 3-2
2. WHEN TAKING MEASUREMENTS ON SERVO AMP TEST POINTS, THE SCOPE MUST BE REFERENCED TO TP1 AND NOT CHASSIS GROUND.
3. ZONE NUMBERS REFER TO LOCATION ON FIGURE FO-5
4. REFER TO FIGURE 3-4 FOR COMPONENT LOCATION

Figure FO-2. Elevation positioning, fault localization diagram


ENTERED FROM
FIGURE FO-1, BLOCK 1
ANTENNA DOES NOT TRAVERSE, BUT ELEVATION FUNCTIONS
CAUTION
ON FCS DISTRIBUTION BOX, SET NORM–STATIC–TEST SWITCH TO STATIC
ZONE 5B
CHECK 6S1 AND 6S2
NO
ZONE 6C
WITH MODE SWITCH TO STOW AND TRAV SWITCH TO RIGHT IS +24V AT 5CR2?
YES
NO
DOES ANTENNA TRAVERSE FROM DISTRIBUTION BOX UNIT 6?
YES
DOES ANTENNA TRAVERSE FROM SIGHT?
YES
NO
ZONE 6C
WITH ACTION SWITCH ENGAGED IS +24V AT 5CR2?
NO
ZONE 5B
CHECK 6S1
ANTENNA DOES NOT TRAVERSE FROM DISTRIBUTION BOX UNIT 6 OR THE SIGHT
CAUTION
BEWARE OF ANTENNA MOVEMENT
SET MODE SWITCH TO STOW AND TRAV SWITCH TO RIGHT OR LEFT FOR ALL MEASUREMENTS
ZONES 20C AND 11B
IS MOTOR VOLTAGE ACROSS 1A3E9 AND E10?
YES
NO
ZONE 21C
IS +24V AT 1A3E8 FOR BRAKE RELEASE
YES
ZONE 20C
CHECK 1A3MG1 AND 1A3L1 FOR MOVEMENT
NO
ZONE 16C
IS +24V AT 6J4-n?
YES
NO
CHECK DISTRIBUTION BOX UNIT 6
NOTE 1
CHECK CABLE W107 AND TRAVERSE DRIVE 1A3
NOTE 2
ZONE 11A
IS MOTOR VOLTAGE ACROSS 5A1TP5 AND TP6?
YES
NO
ZONE 16C
IS MOTOR VOLTAGE ACROSS 6J4-r AND m?
YES
NO
CHECK CABLE W107 AND TRAVERSE DRIVE 1A3
CHECK CABLE W101 AND DISTRIBUTION BOX UNIT 6
ZONE 7A
IS ERROR SIGNAL AT 5A1TP2?
YES
NO
ZONE 10A
IS SIGNAL ON 5A1TP3?
NO
YES
ZONE 6C
CHECK 5K2 AND 5CB2
REPLACE SERVO AMPLIFIER 5A1
ZONE 20D
IS 24VAC ERROR SIGNAL ON 1A3B1 TO R2?
YES
NO
CHECK WIRING FROM TRAVERSE DRIVE 1A3 TO SERVO AMPLIFIER 5A1
ZONE 20D
IS ERROR SIGNAL ON 1A3B1 S1, S2 AND S3?
S1 TO S2 = 25VAC
S1 TO S3 = 75VAC
S2 TO S3 = 50VAC
YES
NO
CHECK SYNCHRO
CHECK SIGHT
AR92555S

NOTES:
1. FOR REMOVAL OF DRIVE ASSEMBLY COVER SEE PARAGRAPH 3-3
2. WHEN TAKING MEASUREMENTS ON SERVO AMP TEST POINTS, THE SCOPE MUST BE REFERENCED TO TP1 AND NOT CHASSIS GROUND
3. ZONE NUMBERS REFER TO LOCATION ON FIGURE FO-5
4. REFER TO FIGURE 3-4 FOR COMPONENT LOCATION

Figure FO-3. Traverse positioning, fault localization diagram


ENTERED FROM FIGURE FO-1, BLOCK ③
ANTENNA STOP LIMIT IMPROPER
IS TRAVERSE IMPROPER?
NO
YES
NOTE 1
ZONE 21D
IS 1A3S1 ENGAGED WITH ANTENNA AT BOTH LIMITS?
NO
ALIGN SWITCH WITH AN/TPM-23
YES
ZONE 21D
DOES CONTINUITY EXIST BETWEEN 1A3J1-a AND q WITH ANTENNA AT LIMIT?
NO
CHECK 1A3S1
YES
ZONE 15C
DOES CONTINUITY EXIST BETWEEN 6J3-J AND W101P2-a WITH ANTENNA AT LIMIT?
NO
ZONE 16C
DOES CONTINUITY EXIST BETWEEN W107P1-q AND P1-a WITH ANTENNA AT LIMIT?
NO
CHECK CABLE W107
YES
CHECK DISTRIBUTION BOX UNIT 6
YES
ZONE 14B
DOES CONTINUITY EXIST BETWEEN W101P1-J AND P2-J?
REPLACE SERVO AMPLIFIER 5A1
NO
CHECK CABLE W108
ZONE 18C
IS 1A2S1 ENGAGED WITH ANTENNA AT BOTH LIMITS?
NO
ALIGN SWITCH WITH AN/TPM-23
YES
NOTE 2
ZONE 16D
DOES CONTINUITY EXIST BETWEEN 1A2J1-a AND q WITH ANTENNA AT LIMIT?
NO
CHECK 1A2S1
YES
ZONE 16A
DOES CONTINUITY EXIST BETWEEN 6J3-W AND W108P2-a WITH ANTENNA AT LIMIT?
NO
ZONE 16B
DOES CONTINUITY EXIST BETWEEN W108P1-q AND P1-a WITH ANTENNA AT LIMIT?
NO
CHECK CABLE W108
YES
ZONE 12B
CHECK DISTRIBUTION BOX UNIT 6
YES
ZONE 12B
DOES CONTINUITY EXIST BETWEEN W101P1-W AND P2-W?
YES
REPLACE SERVO AMPLIFIER 5A2
NO
CHECK CABLE W101

NOTES:

1. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-5
2. IT MAY BE NECESSARY TO READ CONTINUITY AT JUNCTION BOX END OF CABLE
3. REFER TO FIGURE 3-2 FOR COMPONENT LOCATION

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Figure FO-4. Antenna unit 1 current limits, fault localization diagram

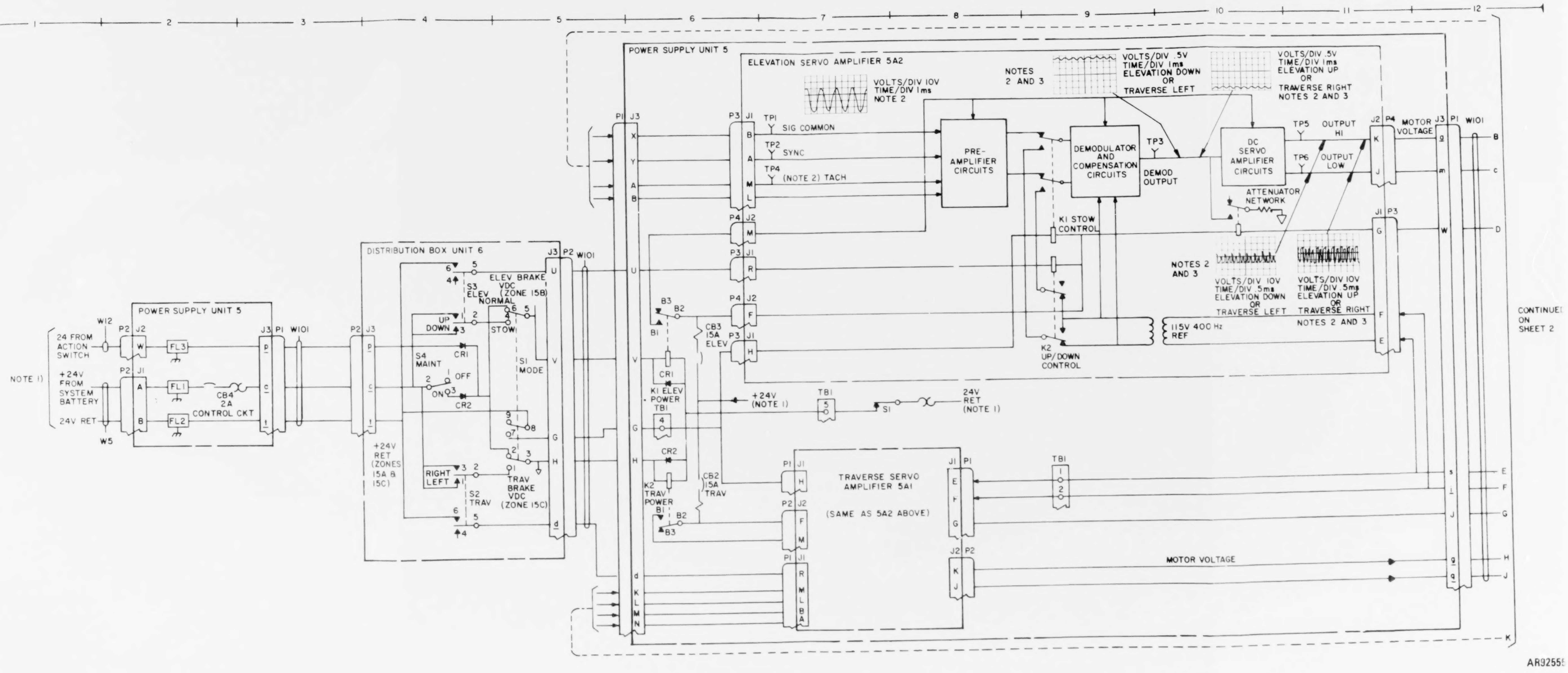
1
2
3
4
5
6
7
8
9
10
11
12
POWER SUPPLY UNIT 5
ELEVATION SERVO AMPLIFIER 5A2
VOLTS/DIV 10V
TIME/DIV 1ms
NOTE 2
NOTES 2 AND 3
VOLTS/DIV .5V
TIME/DIV 1ms
ELEVATION DOWN
OR
TRAVERSE LEFT
VOLTS/DIV .5V
TIME/DIV 1ms
ELEVATION UP
OR
TRAVERSE RIGHT
NOTES 2 AND 3
P1
J3
X
Y
A
B
P3
J1
TP1
SIG COMMON
TP2
SYNC
TP4
(NOTE 2) TACH
M
L
PRE-AMPLIFIER CIRCUITS
DEMODULATOR AND COMPENSATION CIRCUITS
TP3
DEMOD OUTPUT
DC SERVO AMPLIFIER CIRCUITS
TP5
OUTPUT HI
TP6
OUTPUT LOW
ATTENUATOR NETWORK
J2
P4
MOTOR VOLTAGE
K
J
W101
g
m
W
P4
J2
K1 STOW CONTROL
R
U
B3
B2
B1
F
CB3
15A
ELEV
H
K2
UP/DOWN CONTROL
115V 400 Hz REF
NOTES 2 AND 3
VOLTS/DIV 10V
TIME/DIV .5ms
ELEVATION DOWN
OR
TRAVERSE LEFT
VOLTS/DIV 10V
TIME/DIV .5ms
ELEVATION UP
OR
TRAVERSE RIGHT
NOTES 2 AND 3
G
E
CONTINUED ON SHEET 2
D
C
DISTRIBUTION BOX UNIT 6
S3
ELEV
ELEV BRAKE VDC
(ZONE 15B)
NORMAL
UP
DOWN
STOW
S1
MODE
S4
MAINT
CR1
OFF
ON
CR2
RIGHT
LEFT
S2
TRAV
TRAV BRAKE VDC
(ZONE 15C)
+24V RET
(ZONES 15A & 15C)
d
CR1
K1 ELEV POWER
TB1
CR2
K2 TRAV POWER
CB2
15A
TRAV
+24V
(NOTE 1)
TB1
S1
24V RET
(NOTE 1)
TRAVERSE SERVO AMPLIFIER 5A1
(SAME AS 5A2 ABOVE)
MOTOR VOLTAGE
POWER SUPPLY UNIT 5
W12
P2
J2
24 FROM ACTION SWITCH
FL3
NOTE 1)
+24V FROM SYSTEM BATTERY
J1
FL1
CB4
2A
CONTROL CKT
24V RET
FL2
W5
p
c
t
s
i
q
E
F
G
H
J
K
L
N
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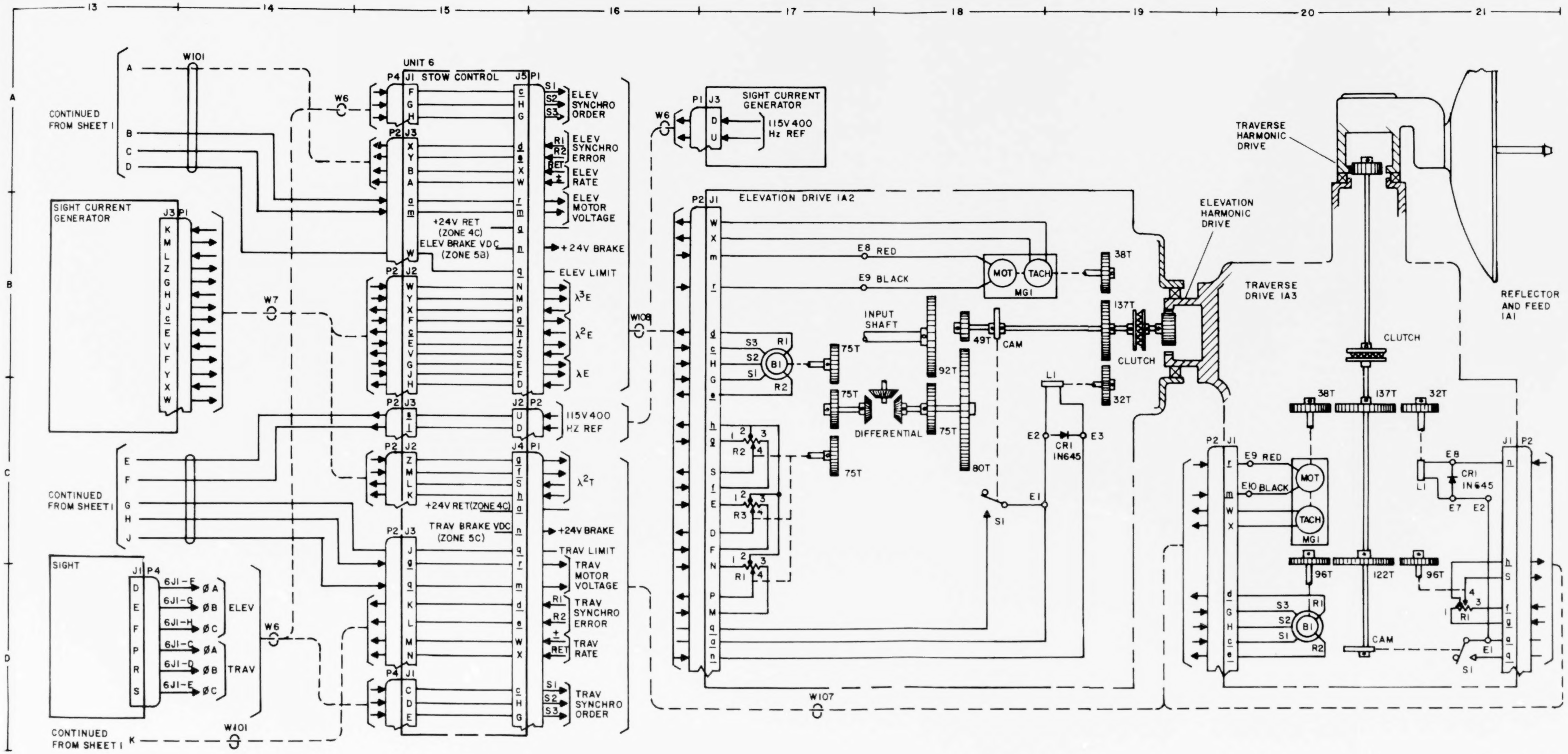
Figure FO-5. Antenna unit 1 subsystem,
functional schematic diagram (sheet 1 of 2


13
14
15
16
17
18
19
20
21
A
B
C
D
CONTINUED FROM SHEET I
W101
W6
W7
UNIT 6
STOW CONTROL
P4 J1
P2 J3
P2 J2
J5 P1
J2 P2
J4 P1
ELEV SYNCHRO ORDER
ELEV SYNCHRO ERROR
ELEV RATE
ELEV MOTOR VOLTAGE
+24V RET (ZONE 4C)
ELEV BRAKE VDC (ZONE 5B)
+24V BRAKE
ELEV LIMIT
λ^3E
λ^2E
λE
115V 400 HZ REF
λ^2T
+24V RET (ZONE 4C)
TRAV BRAKE VDC (ZONE 5C)
TRAV LIMIT
TRAV MOTOR VOLTAGE
TRAV SYNCHRO ERROR
TRAV RATE
TRAV SYNCHRO ORDER
S1
S2
S3
R1
R2
RET
SIGHT CURRENT GENERATOR
J3 P1
SIGHT
J1 P4
6J1-E
6J1-G
6J1-H
6J1-C
6J1-D
ØA
ØB
ØC
ELEV
TRAV
P1 J3
115V 400 Hz REF
W108
W107
P2 J1
ELEVATION DRIVE 1A2
E8 RED
E9 BLACK
MOT
TACH
MG1
B1
R1
R2
R3
INPUT SHAFT
DIFFERENTIAL
75T
92T
80T
49T
CAM
38T
137T
32T
CLUTCH
L1
E1
E2
E3
CR1 1N645
S1
ELEVATION HARMONIC DRIVE
TRAVERSE HARMONIC DRIVE
TRAVERSE DRIVE 1A3
REFLECTOR AND FEED 1A1
E9 RED
E10 BLACK
E7
96T
122T
J1 P2

NOTES:
1. REFER TOFIGURE FO-14.
2. MEASUREMENTS IN SERV
AMPS REFERENCED TO TF
3. +2.5V FOR ELEVATION UF
OR TRAVERSE RIGHT.
−2.5V FOR ELEVATION DO
OR TRAVERSE LEFT.

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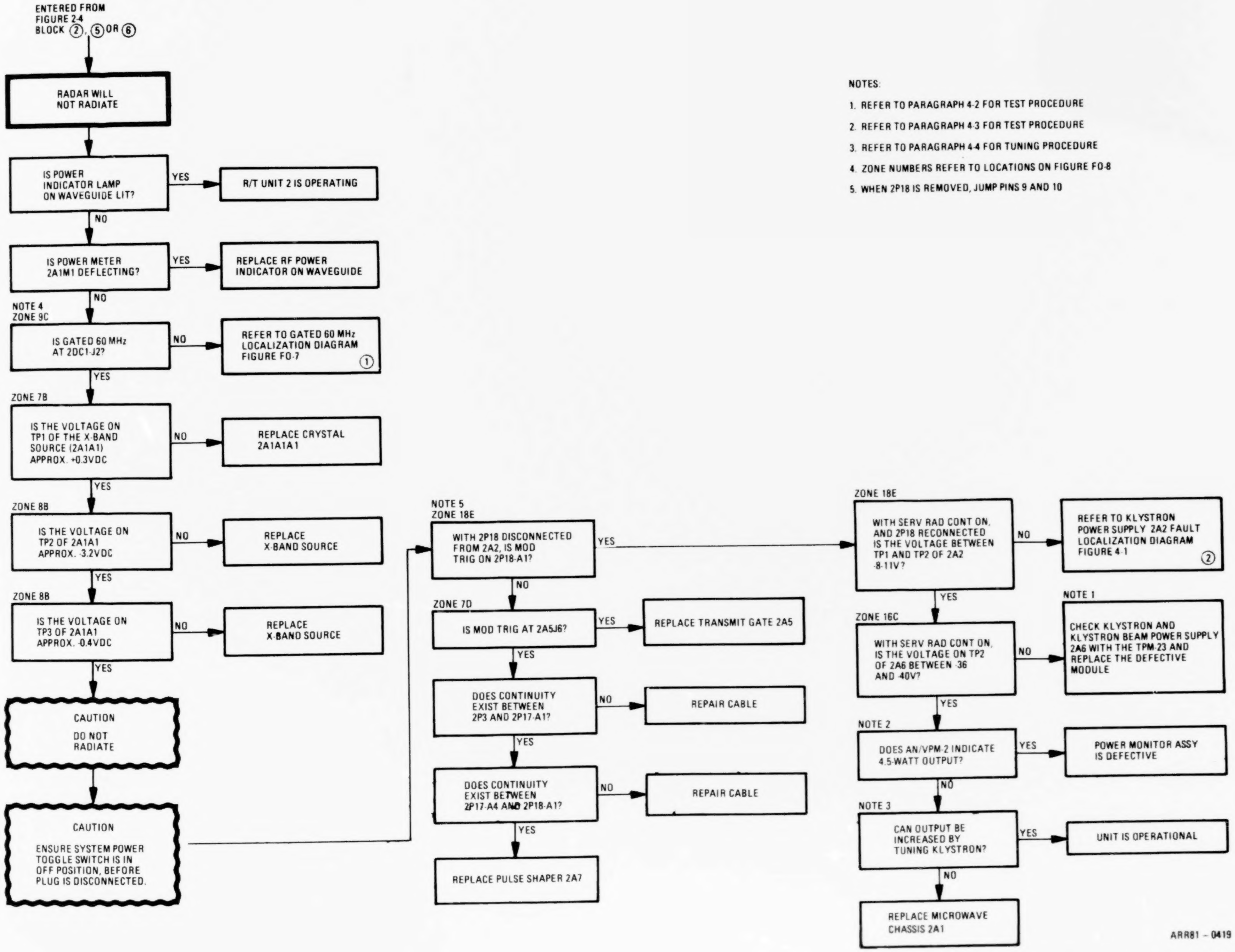
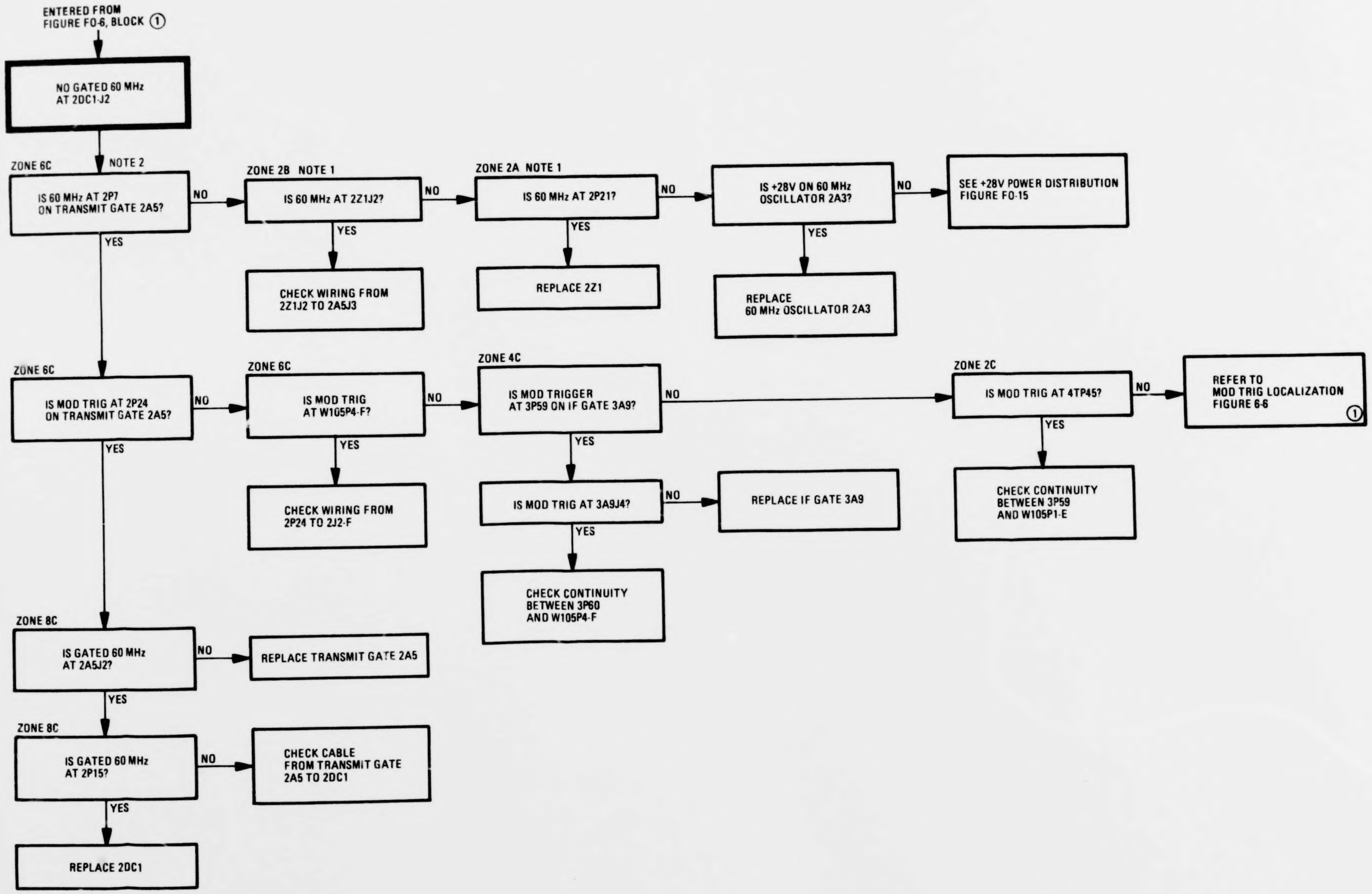
Figure FO-5. Antenna unit 1 subsyste
functional schematic diagram (sheet 2 of
]


ENTERED FROM FIGURE 2-4 BLOCK ②, ⑤ OR ⑥
RADAR WILL NOT RADIATE
IS POWER INDICATOR LAMP ON WAVEGUIDE LIT?
YES
R/T UNIT 2 IS OPERATING
NO
IS POWER METER 2A1M1 DEFLECTING?
YES
REPLACE RF POWER INDICATOR ON WAVEGUIDE
NO
NOTE 4
ZONE 9C
IS GATED 60 MHz AT 2DC1-J2?
NO
REFER TO GATED 60 MHz LOCALIZATION DIAGRAM FIGURE FO-7 ①
YES
ZONE 7B
IS THE VOLTAGE ON TP1 OF THE X-BAND SOURCE (2A1A1) APPROX. +0.3VDC
NO
REPLACE CRYSTAL 2A1A1A1
YES
ZONE 8B
IS THE VOLTAGE ON TP2 OF 2A1A1 APPROX. -3.2VDC
NO
REPLACE X-BAND SOURCE
YES
ZONE 8B
IS THE VOLTAGE ON TP3 OF 2A1A1 APPROX. -0.4VDC
NO
REPLACE X-BAND SOURCE
YES
CAUTION
DO NOT RADIATE
CAUTION
ENSURE SYSTEM POWER TOGGLE SWITCH IS IN OFF POSITION, BEFORE PLUG IS DISCONNECTED.
NOTE 5
ZONE 18E
WITH 2P18 DISCONNECTED FROM 2A2, IS MOD TRIG ON 2P18-A1?
YES
NO
ZONE 7D
IS MOD TRIG AT 2A5J6?
YES
REPLACE TRANSMIT GATE 2A5
YES
DOES CONTINUITY EXIST BETWEEN 2P3 AND 2P17-A1?
NO
REPAIR CABLE
YES
DOES CONTINUITY EXIST BETWEEN 2P17-A4 AND 2P18-A1?
NO
REPAIR CABLE
YES
REPLACE PULSE SHAPER 2A7
ZONE 18E
WITH SERV RAD CONT ON, AND 2P18 RECONNECTED IS THE VOLTAGE BETWEEN TP1 AND TP2 OF 2A2 -8-11V?
NO
REFER TO KLYSTRON POWER SUPPLY 2A2 FAULT LOCALIZATION DIAGRAM FIGURE 4-1 ②
YES
ZONE 16C
WITH SERV RAD CONT ON, IS THE VOLTAGE ON TP2 OF 2A6 BETWEEN -36 AND -40V?
NO
NOTE 1
CHECK KLYSTRON AND KLYSTRON BEAM POWER SUPPLY 2A6 WITH THE TPM-23 AND REPLACE THE DEFECTIVE MODULE
YES
NOTE 2
DOES AN/VPM-2 INDICATE 4.5-WATT OUTPUT?
YES
POWER MONITOR ASSY IS DEFECTIVE
NO
NOTE 3
CAN OUTPUT BE INCREASED BY TUNING KLYSTRON?
YES
UNIT IS OPERATIONAL
NO
REPLACE MICROWAVE CHASSIS 2A1
ARR81 – 0419

NOTES:

1. REFER TO PARAGRAPH 4-2 FOR TEST PROCEDURE
2. REFER TO PARAGRAPH 4-3 FOR TEST PROCEDURE
3. REFER TO PARAGRAPH 4-4 FOR TUNING PROCEDURE
4. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-8
5. WHEN 2P18 IS REMOVED, JUMP PINS 9 AND 10

Figure FO-6. Receiver/transmitter unit 2, fault localization diagram

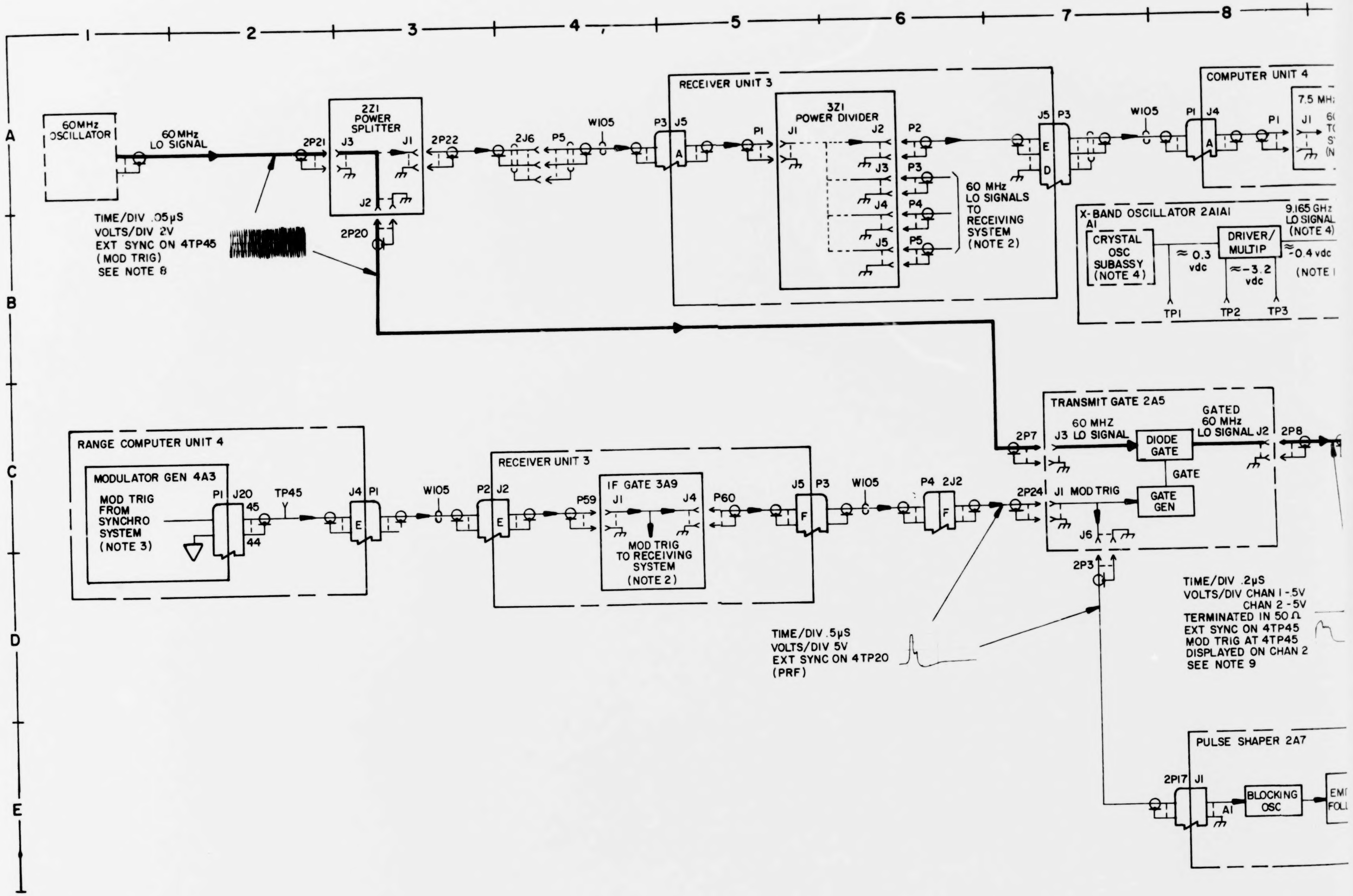

ENTERED FROM
FIGURE FO-6, BLOCK ①
NO GATED 60 MHz AT 2DC1-J2
ZONE 6C
NOTE 2
IS 60 MHz AT 2P7 ON TRANSMIT GATE 2A5?
NO
YES
ZONE 2B NOTE 1
IS 60 MHz AT 2Z1J2?
CHECK WIRING FROM 2Z1J2 TO 2A5J3
ZONE 2A NOTE 1
IS 60 MHz AT 2P21?
REPLACE 2Z1
IS +28V ON 60 MHz OSCILLATOR 2A3?
REPLACE 60 MHz OSCILLATOR 2A3
SEE +28V POWER DISTRIBUTION FIGURE FO-15
ZONE 6C
IS MOD TRIG AT 2P24 ON TRANSMIT GATE 2A5?
ZONE 6C
IS MOD TRIG AT W105P4-F?
CHECK WIRING FROM 2P24 TO 2J2-F
ZONE 4C
IS MOD TRIGGER AT 3P59 ON IF GATE 3A9?
IS MOD TRIG AT 3A9J4?
REPLACE IF GATE 3A9
CHECK CONTINUITY BETWEEN 3P60 AND W105P4-F
ZONE 2C
IS MOD TRIG AT 4TP45?
REFER TO MOD TRIG LOCALIZATION FIGURE 6-6 ①
CHECK CONTINUITY BETWEEN 3P59 AND W105P1-E
ZONE 8C
IS GATED 60 MHz AT 2A5J2?
REPLACE TRANSMIT GATE 2A5
ZONE 8C
IS GATED 60 MHz AT 2P15?
CHECK CABLE FROM TRANSMIT GATE 2A5 TO 2DC1
REPLACE 2DC1

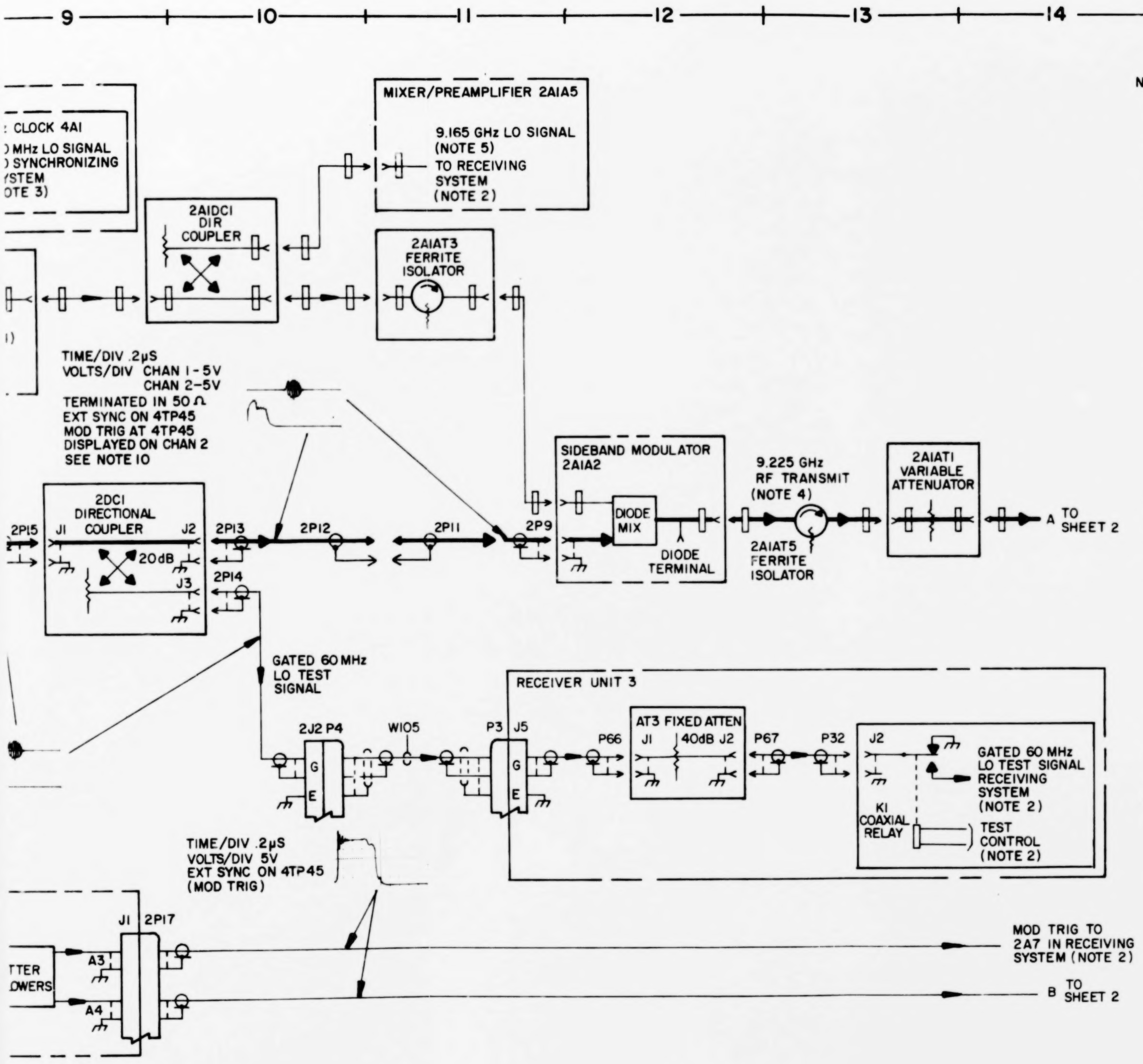
NOTES:

1. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 4-6
2. ZONE NUMBERS REFER TO LOCATIONS ON FIGURE FO-8

ARR81 – 0420

Figure FO-7. Gated 60 MHz loss, fault localization diagram


1
2
3
4
5
6
7
8
A
B
C
D
E
60MHz OSCILLATOR
60 MHz LO SIGNAL
2P21
2Z1 POWER SPLITTER
J3
J1
J2
2P22
2P20
2J6
P5
W105
TIME/DIV .05μS
VOLTS/DIV 2V
EXT SYNC ON 4TP45
(MOD TRIG)
SEE NOTE 8
RECEIVER UNIT 3
P3
J5
A
P1
3Z1 POWER DIVIDER
J1
J2
J3
J4
J5
P2
P3
P4
P5
60 MHz LO SIGNALS TO RECEIVING SYSTEM (NOTE 2)
J5
P3
E
D
W105
COMPUTER UNIT 4
P1
J4
A
P1
7.5 MH
J1
X-BAND OSCILLATOR 2A1A1
A1
CRYSTAL OSC SUBASSY (NOTE 4)
≈ 0.3 vdc
DRIVER/ MULTIP
≈ -3.2 vdc
9.165 GHz LO SIGNAL (NOTE 4)
≈ -0.4 vdc
TP1
TP2
TP3
TRANSMIT GATE 2A5
2P7
60 MHZ J3 LO SIGNAL
DIODE GATE
GATED 60 MHz LO SIGNAL J2
2P8
GATE
J1 MOD TRIG
GATE GEN
J6
2P24
2P3
RANGE COMPUTER UNIT 4
MODULATOR GEN 4A3
MOD TRIG FROM SYNCHRO SYSTEM (NOTE 3)
P1
J20
45
44
TP45
J4
P1
E
W105
P2
J2
E
RECEIVER UNIT 3
P59
IF GATE 3A9
J1
J4
MOD TRIG TO RECEIVING SYSTEM (NOTE 2)
P60
J5
P3
F
W105
P4
2J2
F
TIME/DIV .5μS
VOLTS/DIV 5V
EXT SYNC ON 4TP20
(PRF)
TIME/DIV .2μS
VOLTS/DIV CHAN 1 -5V
CHAN 2 -5V
TERMINATED IN 50 Ω
EXT SYNC ON 4TP45
MOD TRIG AT 4TP45
DISPLAYED ON CHAN 2
SEE NOTE 9
PULSE SHAPER 2A7
2P17
J1
A1
BLOCKING OSC
EM FOL


9
10
11
12
13
14
15
: CLOCK 4AI
) MHz LO SIGNAL
) SYNCHRONIZING
'STEM
OTE 3)
MIXER/PREAMPLIFIER 2AIA5
9.165 GHz LO SIGNAL
(NOTE 5)
TO RECEIVING
SYSTEM
(NOTE 2)
2AIDCI
DIR
COUPLER
2AIAT3
FERRITE
ISOLATOR
TIME/DIV .2μS
VOLTS/DIV CHAN 1-5V
CHAN 2-5V
TERMINATED IN 50 Ω
EXT SYNC ON 4TP45
MOD TRIG AT 4TP45
DISPLAYED ON CHAN 2
SEE NOTE 10
SIDEBAND MODULATOR
2AIA2
DIODE
MIX
DIODE
TERMINAL
9.225 GHz
RF TRANSMIT
(NOTE 4)
2AIAT5
FERRITE
ISOLATOR
2AIATI
VARIABLE
ATTENUATOR
A TO SHEET 2
2DCI
DIRECTIONAL
COUPLER
2PI5
JI
J2
J3
20dB
2PI3
2PI2
2PI1
2P9
2PI4
GATED 60 MHz
LO TEST
SIGNAL
RECEIVER UNIT 3
2J2 P4
WI05
P3 J5
G
E
P66
AT3 FIXED ATTEN
JI
40dB
J2
P67
P32
J2
GATED 60 MHz
LO TEST SIGNAL
RECEIVING
SYSTEM
(NOTE 2)
KI
COAXIAL
RELAY
TEST
CONTROL
(NOTE 2)
TIME/DIV .2μS
VOLTS/DIV 5V
EXT SYNC ON 4TP45
(MOD TRIG)
JI
2PI7
TTER
OWERS
A3
A4
MOD TRIG TO
2A7 IN RECEIVING
SYSTEM (NOTE 2)
B TO SHEET 2

NOTES:

1. ALL COMPONENTS LOCATED IN RECEIVER/TRANSMITTER UNIT 2, UNLESS OTHERWISE INDICATED.
2. REFER TO RECEIVING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-9.
3. REFER TO SYNCHRONIZING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10
4. NOMINAL FREQUENCIES ARE SHOWN FOR X-BAND LO SIGNAL (9.165 GHz) AND RF TRANSMIT PULSE (9.225 GHz). ANY ONE OF SIX SPECIFIC FREQUENCIES CAN BE USED. FREQUENCIES ARE DETERMINED BY CRYSTAL OSCILLATOR SUBASSEMBLY 2AIAIAI AND ARE AS FOLLOWS:

CRYSTAL OSCILLATOR SUBASSEMBLY CHANNEL NO.	X-BAND LO SIGNAL FREQUENCY (GHz)	RF TRANSMIT SIGNAL FREQUENCY (GHz)
1	9.145	9.205
2	9.153	9.213
3	9.161	9.221
4	9.169	9.229
5	9.177	9.237
6	9.185	9.245

5. REFER TO +24-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-14.
6. REFER TO +28-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC FIGURE FO-15.
7. PLUGS 2A6PI AND 2AIA3P4 ARE SECURED TO THEIR MATING JACKS ON THE KLYSTRON POWER SUPPLY 2A2 BY MEANS OF AN INTERLOCK PLATE ASSEMBLY. THE INTERLOCK PLATE ASSEMBLY ENSURES THAT BOTH PLUGS ARE DISCONNECTED AT THE SAME TIME. THIS PREVENTS ACCIDENTIAL DISCONNECTION OF THE KLYSTRON TUBE 2AIA3 LOAD FROM THE KLYSTRON BEAM POWER SUPPLY 2A6. IN ADDITION, THE INTERLOCK PLATE ASSEMBLY DEENERGIZES INTERLOCK SWITCH 2A2SI, WHICH IN TURN DEENERGIZES THE CABINET INTERLOCK CIRCUITRY REMOVING POWER FROM THE TRANSMITTER/RECEIVER: REFER TO +24 VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM (FIGURE FO-14) FOR 2A2SI FUNCTION.
8. WAVEFORM AT 2P21 IS TWICE AMPLITUDE OF 2P20 AND 2P22.
9. FOR WAVEFORM AT 2DCIJ3, SET CHANNEL 1 FOR 5 MV/CM.
10. FOR WAVEFORM AT 2P9, SET CHANNEL 1 FOR 0.1V/CM.
11. VOLTAGES AT 2AIAI TEST POINTS MAY VARY DEPENDING ON MANUFACTURER.

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Figure FO-8. Transmitting subsystem, functional schematic diagram (sheet 1 of 2)

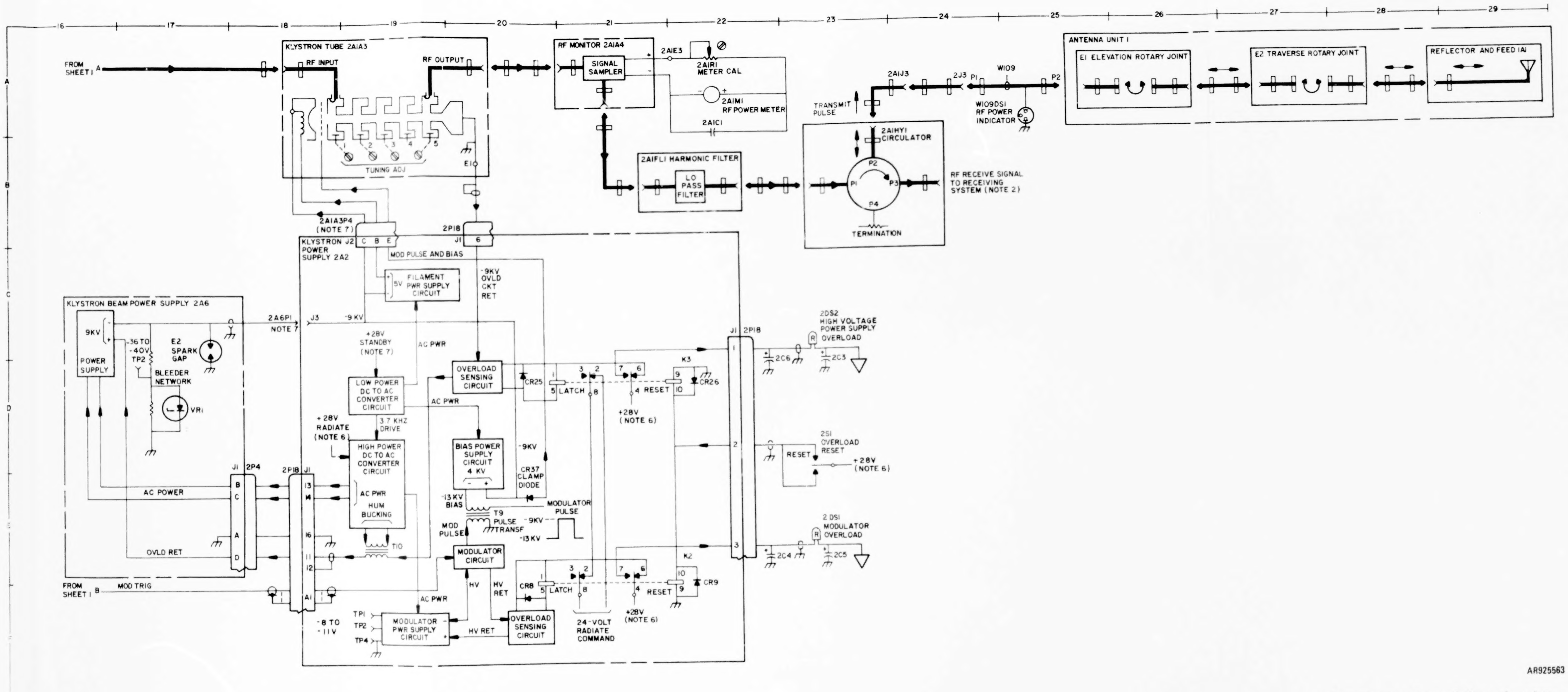
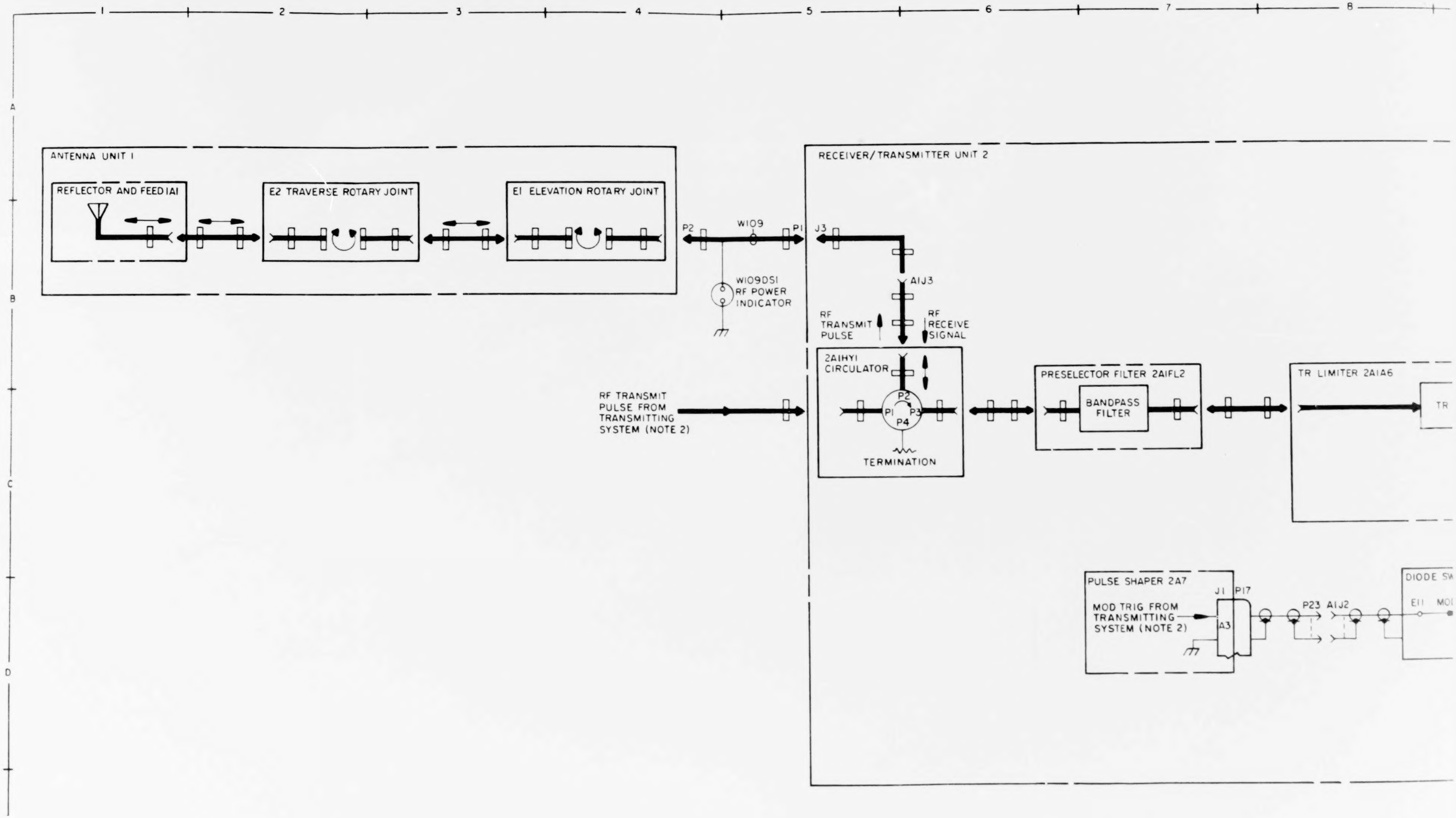
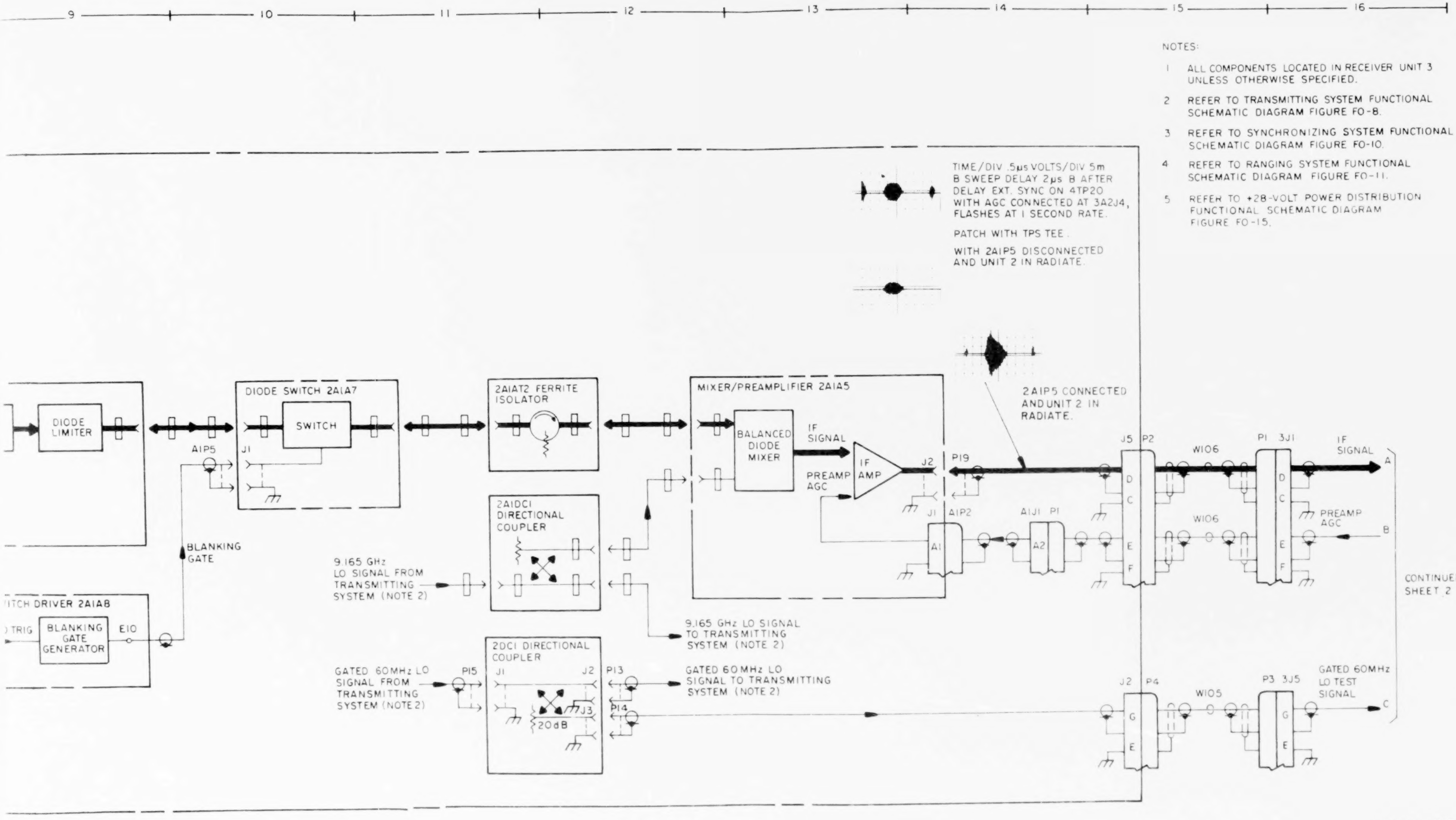

16
17
18
19
20
21
22
23
24
25
26
27
28
29
A
B
C
D
FROM SHEET 1 A
KLYSTRON TUBE 2A1A3
RF INPUT
RF OUTPUT
1
2
3
4
5
TUNING ADJ
E1
RF MONITOR 2A1A4
SIGNAL SAMPLER
2A1E3
2A1R1 METER CAL
2A1M1 RF POWER METER
2A1C1
2A1FL1 HARMONIC FILTER
LO PASS FILTER
TRANSMIT PULSE
2A1HY1 CIRCULATOR
P1
P2
P3
P4
TERMINATION
RF RECEIVE SIGNAL TO RECEIVING SYSTEM (NOTE 2)
2A1J3
2J3
P1
W109
P2
W109DS1 RF POWER INDICATOR
ANTENNA UNIT 1
E1 ELEVATION ROTARY JOINT
E2 TRAVERSE ROTARY JOINT
REFLECTOR AND FEED 1A1
2A1A3P4 (NOTE 7)
2P18
KLYSTRON POWER SUPPLY 2A2
J2
C
B
E
J1
6
MOD PULSE AND BIAS
FILAMENT PWR SUPPLY CIRCUIT
5V
-9KV OVLD CKT RET
KLYSTRON BEAM POWER SUPPLY 2A6
9KV
POWER SUPPLY
-36 TO -40V
TP2
E2 SPARK GAP
BLEEDER NETWORK
VR1
2A6P1 NOTE 7
J3
-9 KV
+28V STANDBY (NOTE 7)
AC PWR
LOW POWER DC TO AC CONVERTER CIRCUIT
OVERLOAD SENSING CIRCUIT
CR25
LATCH
RESET
K3
CR26
+28V (NOTE 6)
J1
2P18
2DS2 HIGH VOLTAGE POWER SUPPLY OVERLOAD
2C6
2C3
AC PWR
3.7 KHZ DRIVE
+28V RADIATE (NOTE 6)
HIGH POWER DC TO AC CONVERTER CIRCUIT
AC PWR
HUM BUCKING
BIAS POWER SUPPLY CIRCUIT 4 KV
-9KV
CR37 CLAMP DIODE
2S1 OVERLOAD RESET
RESET
+28V (NOTE 6)
J1
2P4
AC POWER
OVLD RET
2P18
J1
13
14
16
11
12
A1
T10
-13 KV BIAS
T9 PULSE TRANSF
MODULATOR PULSE
-9KV
-13 KV
MOD PULSE
MODULATOR CIRCUIT
HV
HV RET
2DS1 MODULATOR OVERLOAD
2C4
2C5
K2
CR8
CR9
FROM SHEET 1 B
MOD TRIG
AC PWR
TP1
TP2
TP4
-8 TO -11V
MODULATOR PWR SUPPLY CIRCUIT
HV RET
OVERLOAD SENSING CIRCUIT
24-VOLT RADIATE COMMAND
+28V (NOTE 6)
AR925563

Figure FO-8. Transmitting subsystem, functional schematic diagram (sheet 2 of 2)


1
2
3
4
5
6
7
8
A
B
C
D
ANTENNA UNIT 1
REFLECTOR AND FEED 1A1
E2 TRAVERSE ROTARY JOINT
E1 ELEVATION ROTARY JOINT
P2
W109
P1
W109DS1
RF POWER
INDICATOR
RECEIVER/TRANSMITTER UNIT 2
J3
A1J3
RF
TRANSMIT
PULSE
RF
RECEIVE
SIGNAL
2A1HY1
CIRCULATOR
P2
P1
P3
P4
TERMINATION
RF TRANSMIT
PULSE FROM
TRANSMITTING
SYSTEM (NOTE 2)
PRESELECTOR FILTER 2A1FL2
BANDPASS
FILTER
TR LIMITER 2A1A6
TR
PULSE SHAPER 2A7
MOD TRIG FROM
TRANSMITTING
SYSTEM (NOTE 2)
J1
P17
A3
P23
A1J2
DIODE SW
E11
MO


9
10
11
12
13
14
15
16
DIODE LIMITER
DIODE SWITCH 2A1A7
SWITCH
A1P5
J1
BLANKING GATE
ITCH DRIVER 2A1A8
TRIG
BLANKING GATE GENERATOR
E10
2A1AT2 FERRITE ISOLATOR
2A1DC1 DIRECTIONAL COUPLER
9.165 GHz LO SIGNAL FROM TRANSMITTING SYSTEM (NOTE 2)
9.165 GHz LO SIGNAL TO TRANSMITTING SYSTEM (NOTE 2)
2DC1 DIRECTIONAL COUPLER
J1
J2
J3
20dB
GATED 60MHz LO SIGNAL FROM TRANSMITTING SYSTEM (NOTE 2)
P15
P13
P14
GATED 60 MHz LO SIGNAL TO TRANSMITTING SYSTEM (NOTE 2)
MIXER/PREAMPLIFIER 2A1A5
BALANCED DIODE MIXER
IF SIGNAL
IF AMP
PREAMP AGC
J2
P19
J1
A1P2
A1
A1J1
P1
A2
J5
P2
D
C
E
F
W106
W106
P1
3J1
D
C
E
F
IF SIGNAL
A
PREAMP AGC
B
J2
P4
G
E
W105
P3
3J5
G
E
GATED 60MHz LO TEST SIGNAL
C
CONTINUED SHEET 2

TIME/DIV .5µs VOLTS/DIV 5m
B SWEEP DELAY 2µs B AFTER
DELAY EXT. SYNC ON 4TP20
WITH AGC CONNECTED AT 3A2J4,
FLASHES AT 1 SECOND RATE.

PATCH WITH TPS TEE.

WITH 2A1P5 DISCONNECTED
AND UNIT 2 IN RADIATE.

2A1P5 CONNECTED
AND UNIT 2 IN
RADIATE.

NOTES:

1. ALL COMPONENTS LOCATED IN RECEIVER UNIT 3 UNLESS OTHERWISE SPECIFIED.
2. REFER TO TRANSMITTING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-8.
3. REFER TO SYNCHRONIZING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10.
4. REFER TO RANGING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-11.
5. REFER TO +28-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-15.

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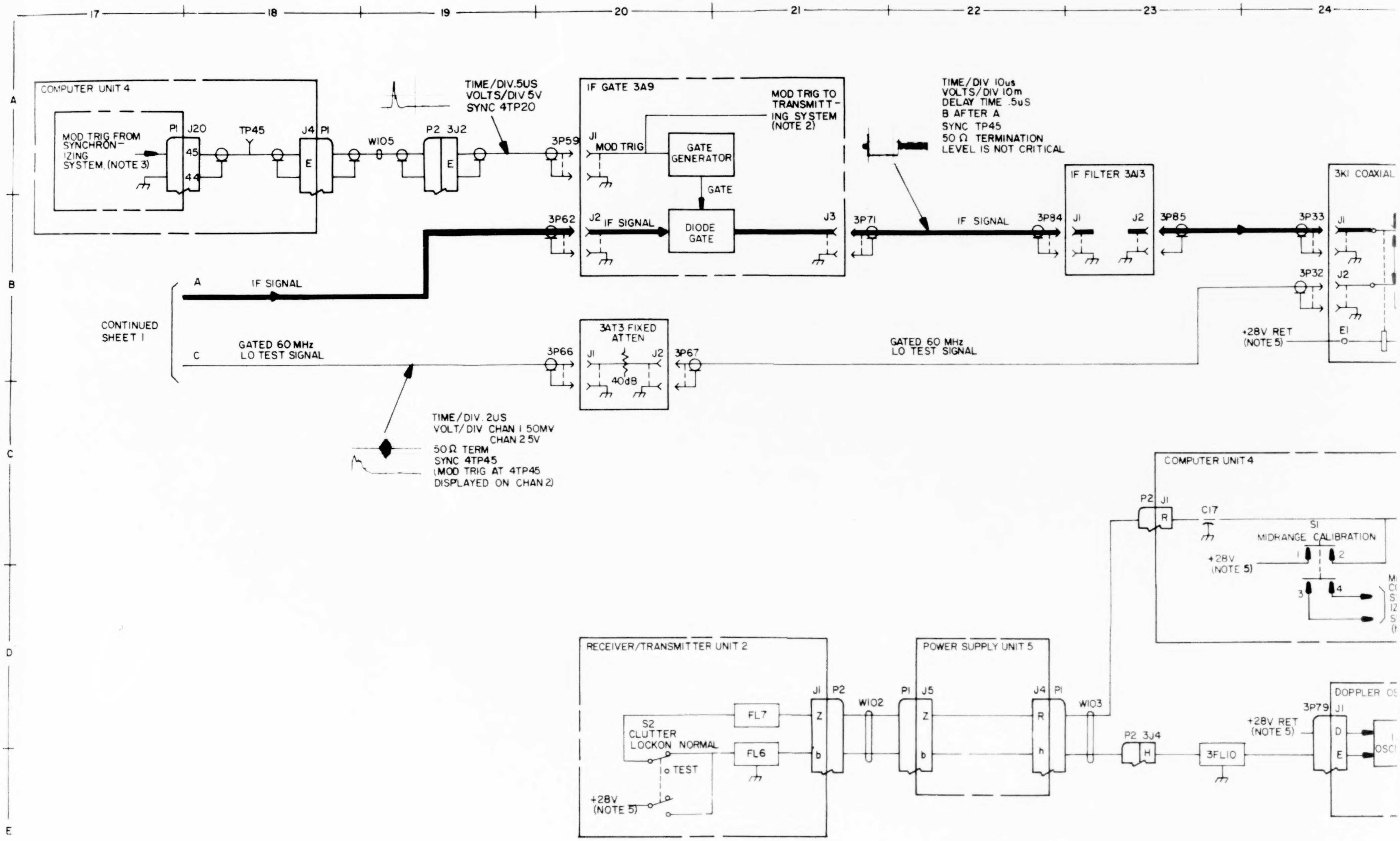
FO-9. Receiving subsystem.
functional schematic diagram (sheet 1 of 3)


17
18
19
20
21
22
23
24
A
B
C
D
E
COMPUTER UNIT 4
MOD TRIG FROM SYNCHRON-IZING SYSTEM (NOTE 3)
P1 J20
45
44
TP45
J4 P1
E
W105
P2 3J2
E
TIME/DIV .5US
VOLTS/DIV 5V
SYNC 4TP20
3P59
IF GATE 3A9
J1
MOD TRIG
GATE GENERATOR
GATE
MOD TRIG TO TRANSMITT-ING SYSTEM (NOTE 2)
3P62
J2 IF SIGNAL
DIODE GATE
J3
TIME/DIV 10us
VOLTS/DIV 10m
DELAY TIME .5uS
B AFTER A
SYNC TP45
50 Ω TERMINATION
LEVEL IS NOT CRITICAL
3P71
IF SIGNAL
3P84
IF FILTER 3A13
J1
J2
3P85
3P33
3K1 COAXIAL
J1
3P32
J2
+28V RET (NOTE 5)
E1
CONTINUED SHEET 1
A
IF SIGNAL
C
GATED 60 MHz LO TEST SIGNAL
3P66
3AT3 FIXED ATTEN
J1
J2
40dB
3P67
GATED 60 MHz LO TEST SIGNAL
TIME/DIV 2US
VOLT/DIV CHAN 1 50MV
CHAN 2 5V
50Ω TERM
SYNC 4TP45
(MOD TRIG AT 4TP45 DISPLAYED ON CHAN 2)
COMPUTER UNIT 4
P2 J1
R
C17
S1
MIDRANGE CALIBRATION
1
2
3
4
+28V (NOTE 5)
RECEIVER/TRANSMITTER UNIT 2
S2
CLUTTER
LOCKON NORMAL
TEST
+28V (NOTE 5)
FL7
FL6
J1 P2
Z
b
W102
POWER SUPPLY UNIT 5
P1 J5
Z
b
J4 P1
R
h
W103
P2 3J4
H
3FL10
+28V RET (NOTE 5)
3P79 J1
D
E
DOPPLER OS
OSC

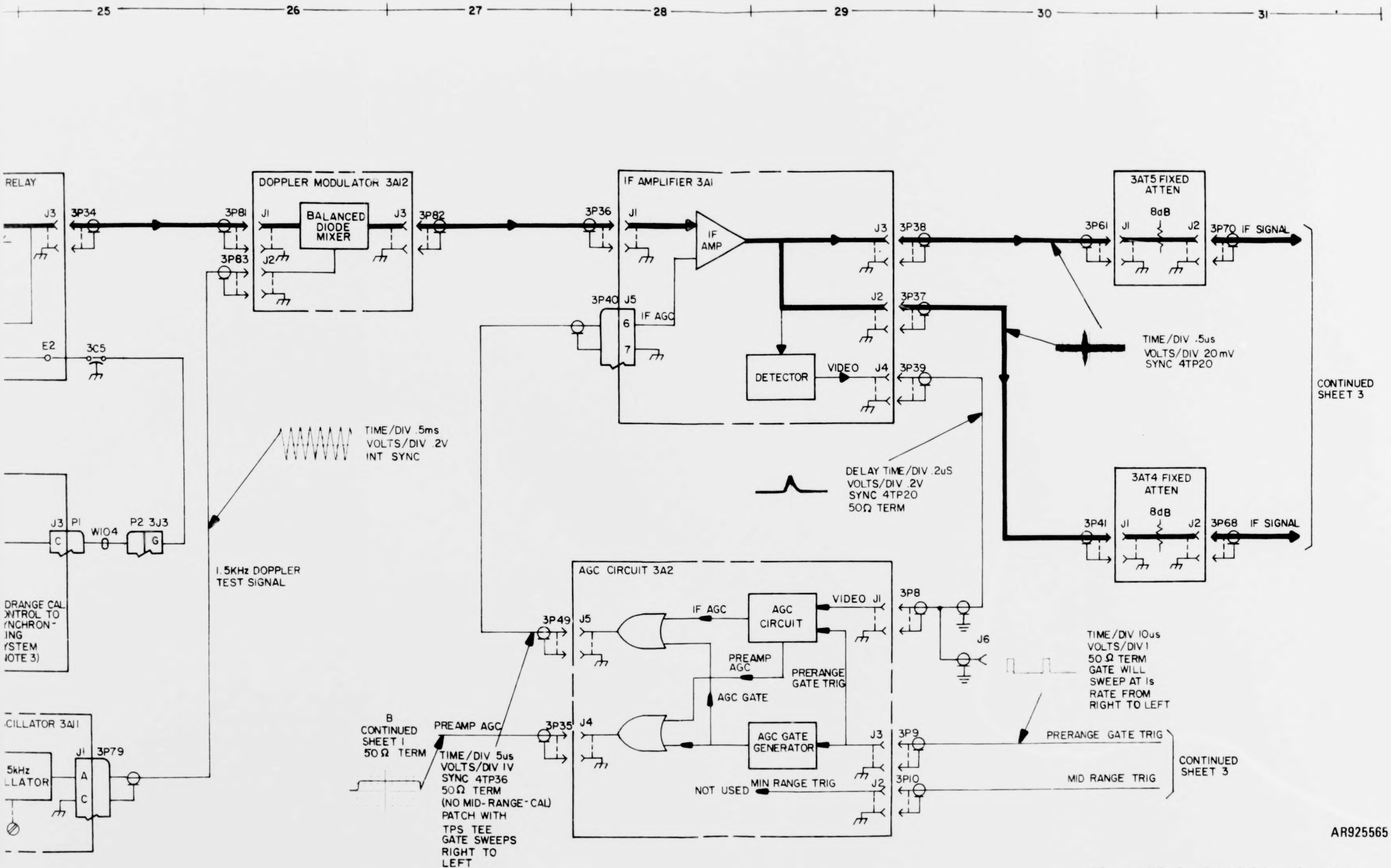
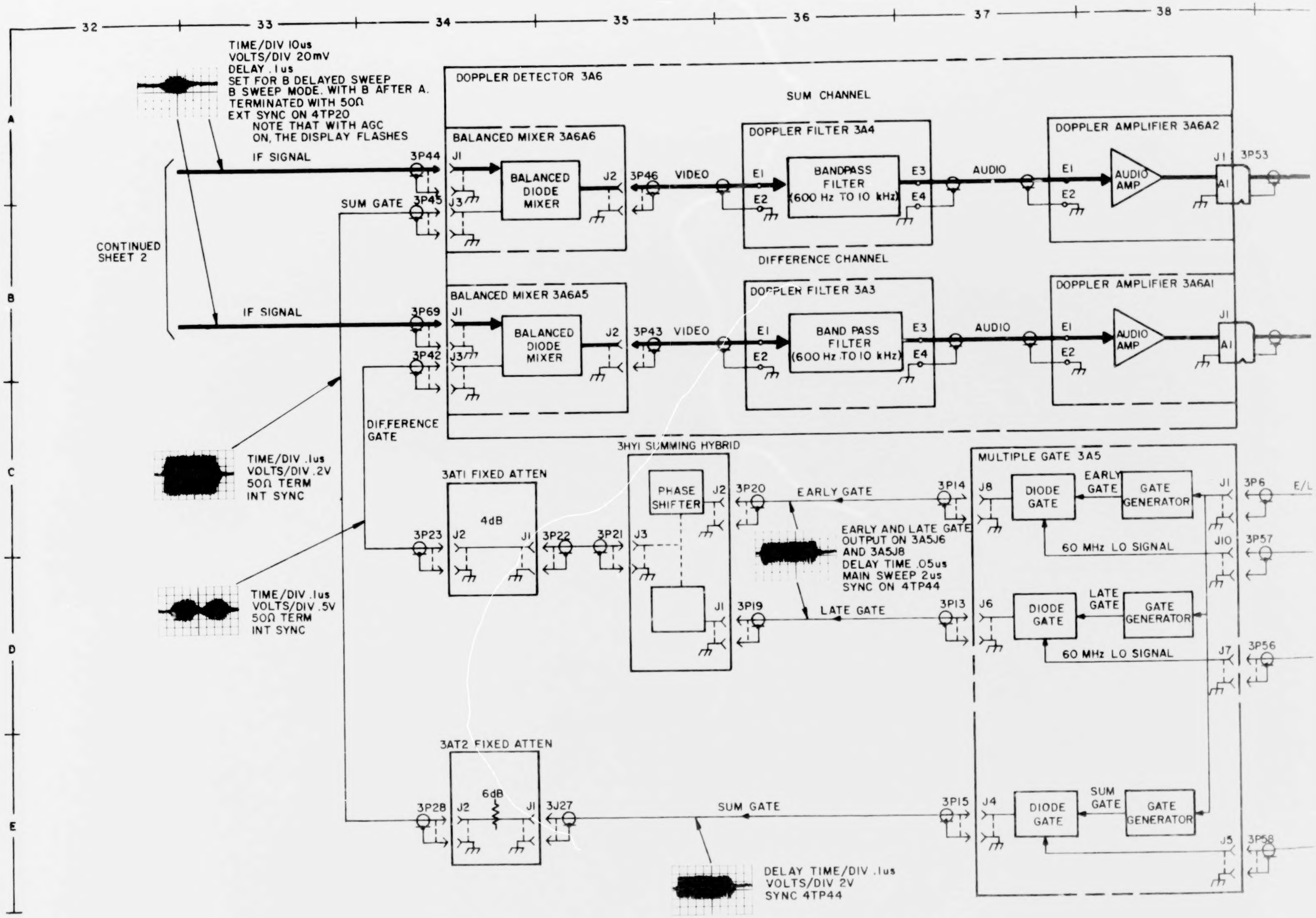

25
26
27
28
29
30
31
RELAY
J3
3P34
3P81
DOPPLER MODULATOR 3A12
J1
BALANCED DIODE MIXER
J3
J2
3P83
3P82
3P36
IF AMPLIFIER 3A1
J1
IF AMP
J3
J2
J4
3P40
J5
6
7
IF AGC
DETECTOR
VIDEO
3P38
3P37
3P39
3AT5 FIXED ATTEN
3P61
J1
8dB
J2
3P70
IF SIGNAL
TIME/DIV .5us
VOLTS/DIV 20mV
SYNC 4TP20
CONTINUED SHEET 3
E2
3C5
TIME/DIV .5ms
VOLTS/DIV .2V
INT SYNC
DELAY TIME/DIV .2uS
VOLTS/DIV .2V
SYNC 4TP20
50Ω TERM
3AT4 FIXED ATTEN
3P41
J1
8dB
J2
3P68
IF SIGNAL
J3
P1
W104
P2
3J3
C
G
1.5KHz DOPPLER TEST SIGNAL
DRANGE CAL
ONTROL TO
YNCHRON-
ING
YSTEM
NOTE 3)
AGC CIRCUIT 3A2
3P49
J5
IF AGC
AGC CIRCUIT
VIDEO
J1
3P8
J6
PREAMP AGC
PRERANGE GATE TRIG
AGC GATE
TIME/DIV 10us
VOLTS/DIV 1
50 Ω TERM
GATE WILL SWEEP AT 1s RATE FROM RIGHT TO LEFT
CILLATOR 3A11
J1
3P79
5kHz
LLATOR
A
C
B
CONTINUED SHEET 1
50 Ω TERM
PREAMP AGC
3P35
J4
AGC GATE GENERATOR
J3
3P9
PRERANGE GATE TRIG
TIME/DIV 5us
VOLTS/DIV 1V
SYNC 4TP36
50Ω TERM
(NO MID-RANGE-CAL)
PATCH WITH
TPS TEE
GATE SWEEPS
RIGHT TO
LEFT
NOT USED
MIN RANGE TRIG
J2
3P10
MID RANGE TRIG
CONTINUED SHEET 3
AR925565

Figure FO-9. Receiving subsystem, functional schematic diagram (sheet 2 of 3)


32
33
34
35
36
37
38
A
B
C
D
E
TIME/DIV 10us
VOLTS/DIV 20mV
DELAY .1us
SET FOR B DELAYED SWEEP
B SWEEP MODE. WITH B AFTER A.
TERMINATED WITH 50Ω
EXT SYNC ON 4TP20
NOTE THAT WITH AGC
ON, THE DISPLAY FLASHES
CONTINUED
SHEET 2
IF SIGNAL
IF SIGNAL
SUM GATE
DIFFERENCE
GATE
DOPPLER DETECTOR 3A6
SUM CHANNEL
DIFFERENCE CHANNEL
BALANCED MIXER 3A6A6
BALANCED
DIODE
MIXER
BALANCED MIXER 3A6A5
BALANCED
DIODE
MIXER
3P44
3P45
3P69
3P42
J1
J2
J3
3P46
VIDEO
3P43
VIDEO
DOPPLER FILTER 3A4
BANDPASS
FILTER
(600 Hz TO 10 kHz)
DOPPLER FILTER 3A3
BAND PASS
FILTER
(600 Hz TO 10 kHz)
E1
E2
E3
E4
AUDIO
AUDIO
DOPPLER AMPLIFIER 3A6A2
DOPPLER AMPLIFIER 3A6A1
AUDIO
AMP
A1
3P53
TIME/DIV .1us
VOLTS/DIV .2V
50Ω TERM
INT SYNC
TIME/DIV .1us
VOLTS/DIV .5V
50Ω TERM
INT SYNC
3AT1 FIXED ATTEN
4dB
3P23
3P22
3P21
3HY1 SUMMING HYBRID
PHASE
SHIFTER
J3
3P20
3P19
EARLY GATE
LATE GATE
3P14
3P13
EARLY AND LATE GATE
OUTPUT ON 3A5J6
AND 3A5J8
DELAY TIME .05us
MAIN SWEEP 2us
SYNC ON 4TP44
MULTIPLE GATE 3A5
J8
J6
J4
DIODE
GATE
EARLY
GATE
LATE
GATE
SUM
GATE
GATE
GENERATOR
60 MHz LO SIGNAL
60 MHz LO SIGNAL
J10
J7
J5
3P6
E/L
3P57
3P56
3P58
3AT2 FIXED ATTEN
6dB
3P28
3J27
SUM GATE
3P15
DELAY TIME/DIV .1us
VOLTS/DIV 2V
SYNC 4TP44

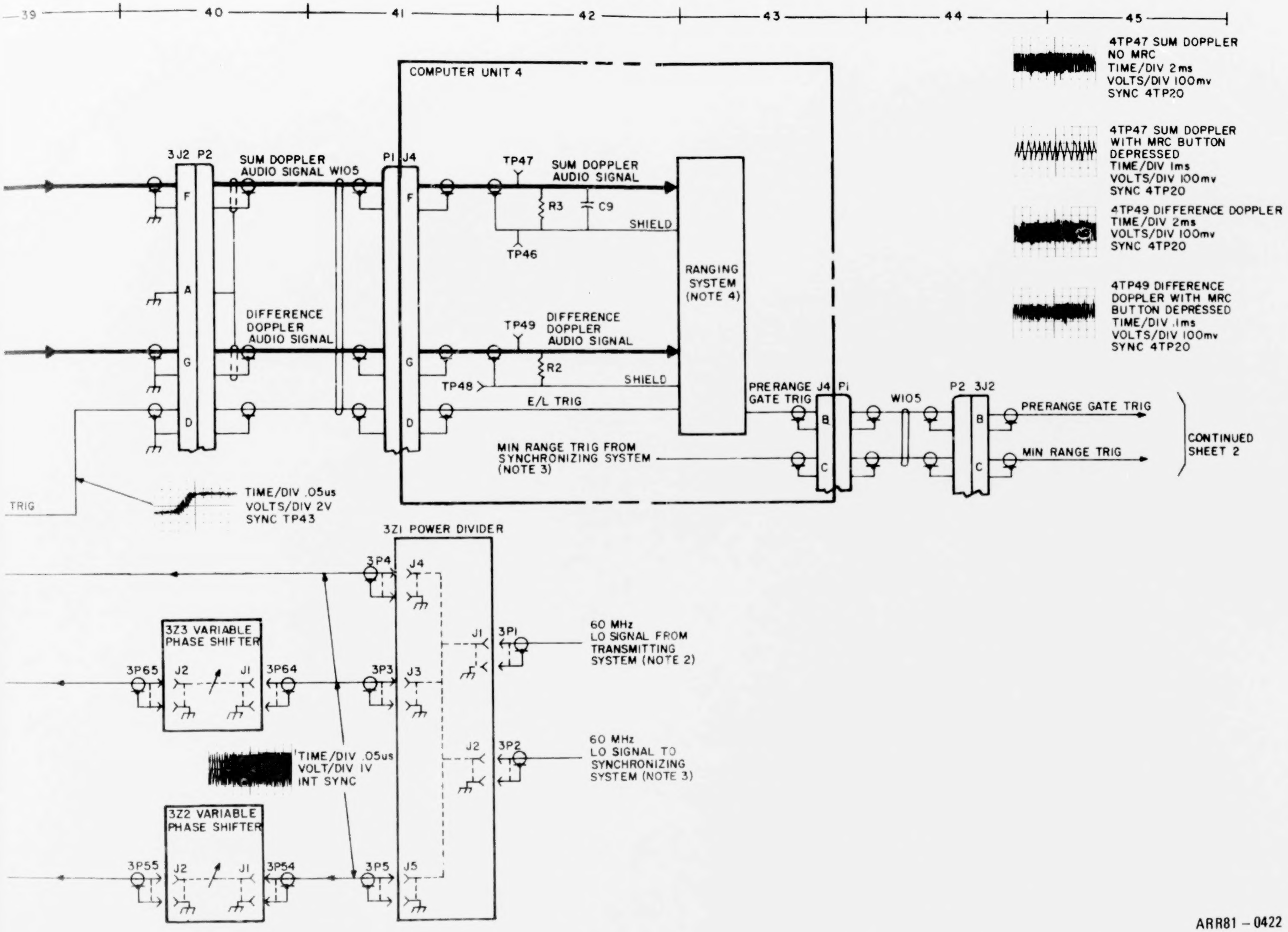

39
40
41
42
43
44
45
4TP47 SUM DOPPLER
NO MRC
TIME/DIV 2ms
VOLTS/DIV 100mv
SYNC 4TP20
4TP47 SUM DOPPLER
WITH MRC BUTTON
DEPRESSED
TIME/DIV 1ms
VOLTS/DIV 100mv
SYNC 4TP20
4TP49 DIFFERENCE DOPPLER
TIME/DIV 2ms
VOLTS/DIV 100mv
SYNC 4TP20
4TP49 DIFFERENCE
DOPPLER WITH MRC
BUTTON DEPRESSED
TIME/DIV .1ms
VOLTS/DIV 100mv
SYNC 4TP20
COMPUTER UNIT 4
3J2 P2
SUM DOPPLER
AUDIO SIGNAL W105
P1 J4
TP47
SUM DOPPLER
AUDIO SIGNAL
R3
C9
SHIELD
TP46
F
A
G
D
DIFFERENCE
DOPPLER
AUDIO SIGNAL
TP49
DIFFERENCE
DOPPLER
AUDIO SIGNAL
R2
SHIELD
TP48
E/L TRIG
RANGING
SYSTEM
(NOTE 4)
PRERANGE
GATE TRIG
J4 P1
W105
P2 3J2
B
C
PRERANGE GATE TRIG
MIN RANGE TRIG
CONTINUED
SHEET 2
MIN RANGE TRIG FROM
SYNCHRONIZING SYSTEM
(NOTE 3)
TRIG
TIME/DIV .05us
VOLTS/DIV 2V
SYNC TP43
3Z1 POWER DIVIDER
3P4
J4
J1
3P1
60 MHz
LO SIGNAL FROM
TRANSMITTING
SYSTEM (NOTE 2)
3Z3 VARIABLE
PHASE SHIFTER
3P65
J2
J1
3P64
3P3
J3
TIME/DIV .05us
VOLT/DIV 1V
INT SYNC
J2
3P2
60 MHz
LO SIGNAL TO
SYNCHRONIZING
SYSTEM (NOTE 3)
3Z2 VARIABLE
PHASE SHIFTER
3P55
J2
J1
3P54
3P5
J5

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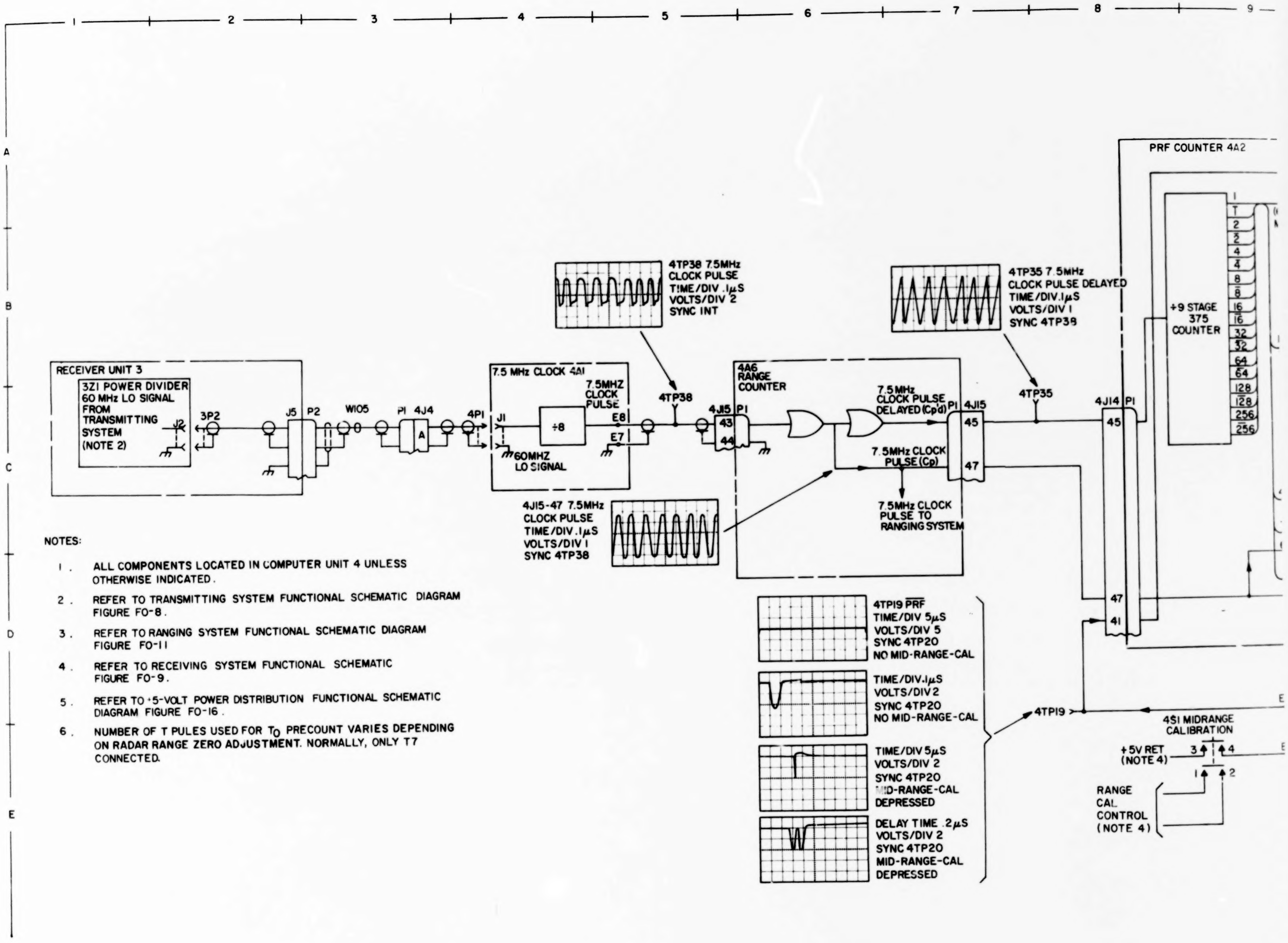
Figure FO-9. Receiving subsystem, functional schematic diagram (sheet 3 of 3)


1
2
3
4
5
6
7
8
9
A
B
C
D
E
RECEIVER UNIT 3
3Z1 POWER DIVIDER
60 MHz LO SIGNAL
FROM
TRANSMITTING
SYSTEM
(NOTE 2)
J2
3P2
J5
P2
W105
P1
4J4
A
4P1
7.5 MHz CLOCK 4A1
J1
÷8
7.5MHZ
CLOCK
PULSE
E8
E7
60MHZ
LO SIGNAL
4TP38 7.5MHz
CLOCK PULSE
TIME/DIV .1μS
VOLTS/DIV 2
SYNC INT
4TP38
4J15
P1
43
44
4A6
RANGE
COUNTER
7.5 MHz
CLOCK PULSE
DELAYED (Cp'd)
7.5MHz CLOCK
PULSE (Cp)
7.5MHz CLOCK
PULSE TO
RANGING SYSTEM
P1
4J15
45
47
4J15-47 7.5MHz
CLOCK PULSE
TIME/DIV .1μS
VOLTS/DIV 1
SYNC 4TP38
4TP35 7.5MHz
CLOCK PULSE DELAYED
TIME/DIV .1μS
VOLTS/DIV 1
SYNC 4TP38
4TP35
4J14
P1
45
47
41
PRF COUNTER 4A2
+9 STAGE
375
COUNTER
1
T
2
2̄
4
4̄
8
8̄
16
1̄6
32
3̄2
64
6̄4
128
1̄28
256
2̄56
4TP19 P̄R̄F̄
TIME/DIV 5μS
VOLTS/DIV 5
SYNC 4TP20
NO MID-RANGE-CAL
TIME/DIV .1μS
VOLTS/DIV 2
SYNC 4TP20
NO MID-RANGE-CAL
TIME/DIV 5μS
VOLTS/DIV 2
SYNC 4TP20
MID-RANGE-CAL
DEPRESSED
DELAY TIME .2μS
VOLTS/DIV 2
SYNC 4TP20
MID-RANGE-CAL
DEPRESSED
4TP19
4S1 MIDRANGE
CALIBRATION
+5V RET
(NOTE 4)
3
4
1
2
RANGE
CAL
CONTROL
(NOTE 4)
E
E

NOTES:

1. ALL COMPONENTS LOCATED IN COMPUTER UNIT 4 UNLESS OTHERWISE INDICATED.
2. REFER TO TRANSMITTING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-8.
3. REFER TO RANGING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-11
4. REFER TO RECEIVING SYSTEM FUNCTIONAL SCHEMATIC FIGURE FO-9.
5. REFER TO +5-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-16.
6. NUMBER OF T PULES USED FOR T_0 PRECOUNT VARIES DEPENDING ON RADAR RANGE ZERO ADJUSTMENT. NORMALLY, ONLY T7 CONNECTED.

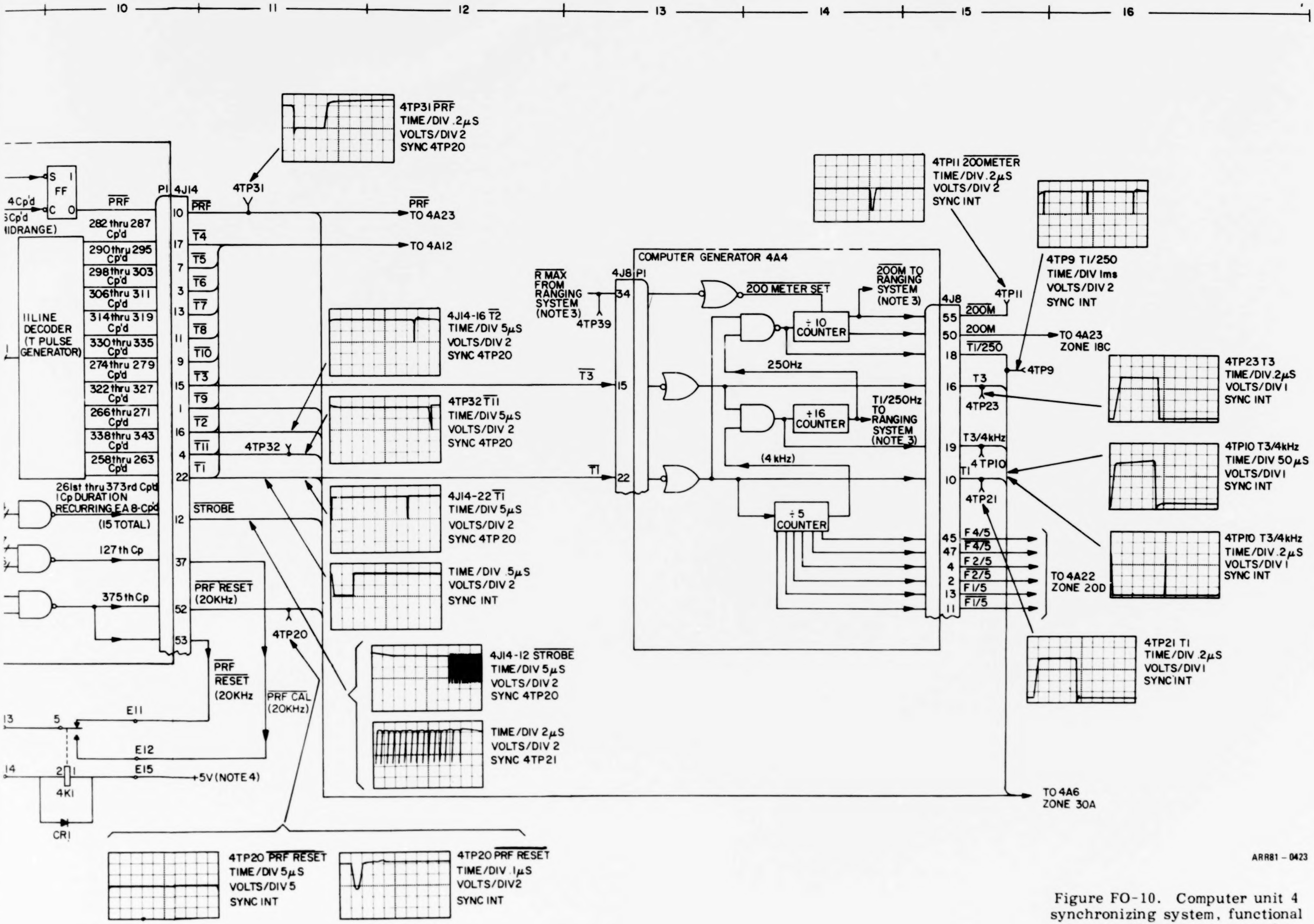

10
11
12
13
14
15
16
4TP31 PRF
TIME/DIV .2μS
VOLTS/DIV 2
SYNC 4TP20
S
FF
C
4Cp'd
5Cp'd
IDRANGE)
PRF
P1
4J14
4TP31
PRF
TO 4A23
TO 4A12
282 thru 287 Cp'd
290 thru 295 Cp'd
298 thru 303 Cp'd
306 thru 311 Cp'd
314 thru 319 Cp'd
330 thru 335 Cp'd
274 thru 279 Cp'd
322 thru 327 Cp'd
266 thru 271 Cp'd
338 thru 343 Cp'd
258 thru 263 Cp'd
11 LINE DECODER (T PULSE GENERATOR)
T4
T5
T6
T7
T8
T10
T3
T9
T2
T11
T1
4TP32
261st thru 373rd Cp'd 1Cp DURATION RECURRING EA 8-Cp'd
(15 TOTAL)
STROBE
127th Cp
375th Cp
PRF RESET (20KHz)
4TP20
PRF RESET (20KHz
PRF CAL (20KHz)
E11
E12
E15
+5V (NOTE 4)
4K1
CR1
4J14-16 T2
TIME/DIV 5μS
VOLTS/DIV 2
SYNC 4TP20
4TP32 T11
TIME/DIV 5μS
VOLTS/DIV 2
SYNC 4TP20
4J14-22 T1
TIME/DIV 5μS
VOLTS/DIV 2
SYNC 4TP 20
TIME/DIV .5μS
VOLTS/DIV 2
SYNC INT
4J14-12 STROBE
TIME/DIV 5μS
VOLTS/DIV 2
SYNC 4TP20
TIME/DIV 2μS
VOLTS/DIV 2
SYNC 4TP21
4TP20 PRF RESET
TIME/DIV 5μS
VOLTS/DIV 5
SYNC INT
4TP20 PRF RESET
TIME/DIV .1μS
VOLTS/DIV2
SYNC INT
R MAX FROM RANGING SYSTEM (NOTE 3)
4TP39
4J8 P1
COMPUTER GENERATOR 4A4
200 METER SET
200M TO RANGING SYSTEM (NOTE 3)
÷10 COUNTER
250Hz
÷16 COUNTER
T1/250Hz TO RANGING SYSTEM (NOTE 3)
(4 kHz)
÷5 COUNTER
4TP11 200METER
TIME/DIV .2μS
VOLTS/DIV 2
SYNC INT
4TP11
4TP9 T1/250
TIME/DIV 1ms
VOLTS/DIV 2
SYNC INT
4J8
200M
200M
TO 4A23 ZONE 18C
T1/250
4TP9
T3
4TP23
T3/4kHz
4TP10
T1
4TP21
F4/5
F4/5
F2/5
F2/5
F1/5
F1/5
TO 4A22 ZONE 20D
4TP23 T3
TIME/DIV .2μS
VOLTS/DIV 1
SYNC INT
4TP10 T3/4kHz
TIME/DIV 50μS
VOLTS/DIV 1
SYNC INT
4TP10 T3/4kHz
TIME/DIV .2μS
VOLTS/DIV 1
SYNC INT
4TP21 T1
TIME/DIV .2μS
VOLTS/DIV 1
SYNC INT
TO 4A6 ZONE 30A
ARR81 - 0423

Figure FO-10. Computer unit 4 synchronizing system, functional schematic diagram (sheet 1 of 2)

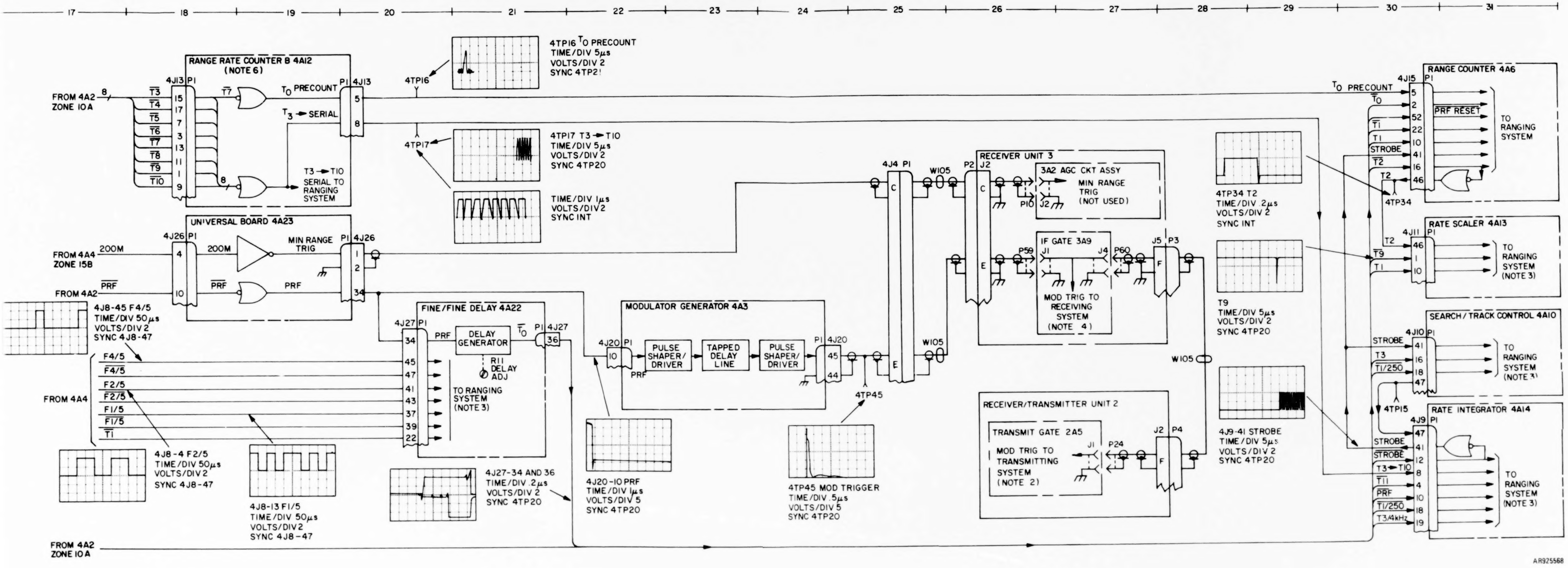

17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
RANGE RATE COUNTER B 4A12
(NOTE 6)
FROM 4A2
ZONE 10A
8
4J13 P1
$\overline{T3}$
$\overline{T4}$
$\overline{T5}$
$\overline{T6}$
$\overline{T7}$
$\overline{T8}$
$\overline{T9}$
$\overline{T10}$
15
17
7
3
13
11
1
9
$\overline{T7}$
T_0 PRECOUNT
T_3 → SERIAL
T3 → T10
SERIAL TO
RANGING
SYSTEM
P1 4J13
5
8
4TP16
4TP16 T_0 PRECOUNT
TIME/DIV 5μs
VOLTS/DIV 2
SYNC 4TP2!
4TP17
4TP17 T3 → T10
TIME/DIV 5μs
VOLTS/DIV 2
SYNC 4TP20
TIME/DIV 1μs
VOLTS/DIV2
SYNC INT
UNIVERSAL BOARD 4A23
FROM 4A4
ZONE 15B
200M
4J26 P1
4
10
200M
MIN RANGE
TRIG
P1 4J26
1
2
34
FROM 4A2
$\overline{PRF}$
$\overline{PRF}$
PRF
4J8-45 F4/5
TIME/DIV 50μs
VOLTS/DIV 2
SYNC 4J8-47
FROM 4A4
F4/5
$\overline{F4/5}$
F2/5
$\overline{F2/5}$
F1/5
$\overline{F1/5}$
$\overline{T1}$
4J8-4 F2/5
TIME/DIV 50μs
VOLTS/DIV 2
SYNC 4J8-47
4J8-13 F1/5
TIME/DIV 50μs
VOLTS/DIV 2
SYNC 4J8-47
FINE/FINE DELAY 4A22
4J27 P1
34
45
47
41
43
37
39
22
PRF
DELAY
GENERATOR
$\overline{T_0}$
P1 4J27
36
R11
DELAY
ADJ
TO RANGING
SYSTEM
(NOTE 3)
4J27-34 AND 36
TIME/DIV .2μs
VOLTS/DIV 2
SYNC 4TP20
FROM 4A2
ZONE 10A
MODULATOR GENERATOR 4A3
4J20 P1
10
PRF
PULSE
SHAPER/
DRIVER
TAPPED
DELAY
LINE
PULSE
SHAPER/
DRIVER
P1 4J20
45
44
4J20-10 PRF
TIME/DIV 1μs
VOLTS/DIV 5
SYNC 4TP20
4TP45
4TP45 MOD TRIGGER
TIME/DIV .5μs
VOLTS/DIV 5
SYNC 4TP20
4J4 P1
C
E
W105
W105
P2 J2
C
E
RECEIVER UNIT 3
3A2 AGC CKT ASSY
MIN RANGE
TRIG
(NOT USED)
P10 J2
IF GATE 3A9
P59 J1
J4 P60
MOD TRIG TO
RECEIVING
SYSTEM
(NOTE 4)
J5 P3
F
W105
RECEIVER/TRANSMITTER UNIT 2
TRANSMIT GATE 2A5
MOD TRIG TO
TRANSMITTING
SYSTEM
(NOTE 2)
J1
P24
J2 P4
F
4TP34 T2
TIME/DIV .2μs
VOLTS/DIV 2
SYNC INT
T9
TIME/DIV 5μs
VOLTS/DIV 2
SYNC 4TP20
4J9-41 STROBE
TIME/DIV 5μs
VOLTS/DIV 2
SYNC 4TP20
RANGE COUNTER 4A6
T_0 PRECOUNT
4J15 P1
$\overline{T_0}$
$\overline{T1}$
T1
STROBE
$\overline{T2}$
T2
5
2
52
22
10
41
16
46
$\overline{PRF\ RESET}$
TO
RANGING
SYSTEM
4TP34
RATE SCALER 4A13
4J11 P1
T2
$\overline{T9}$
T1
46
1
10
TO
RANGING
SYSTEM
(NOTE 3)
SEARCH/TRACK CONTROL 4A10
4J10 P1
STROBE
T3
$\overline{T1/250}$
41
16
18
47
TO
RANGING
SYSTEM
(NOTE 3)
4TP15
RATE INTEGRATOR 4A14
4J9 P1
47
STROBE
$\overline{STROBE}$
T3 → T10
$\overline{T11}$
$\overline{PRF}$
$\overline{T1/250}$
T3/4kHz
41
12
8
4
10
18
19
TO
RANGING
SYSTEM
(NOTE 3)
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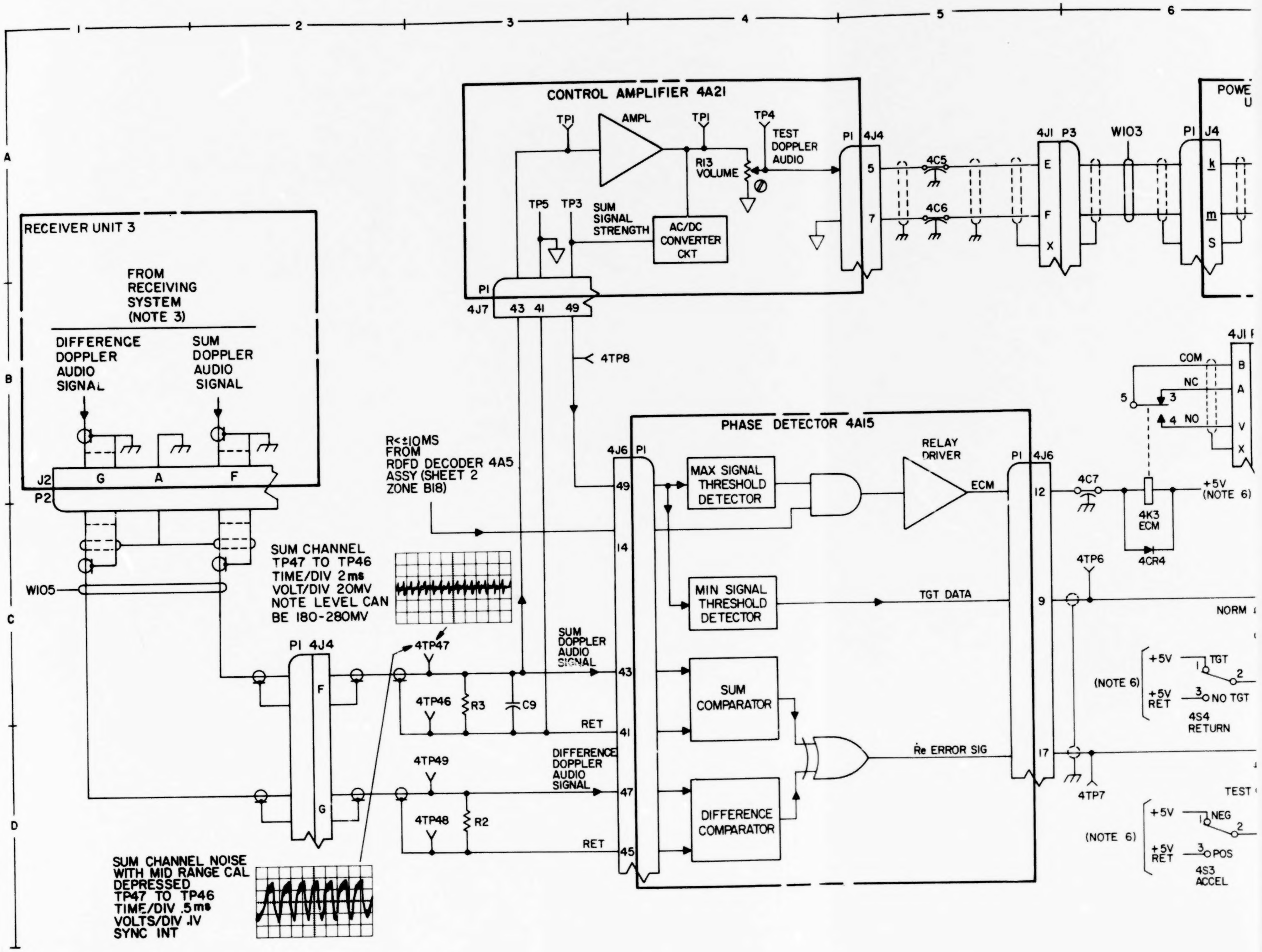
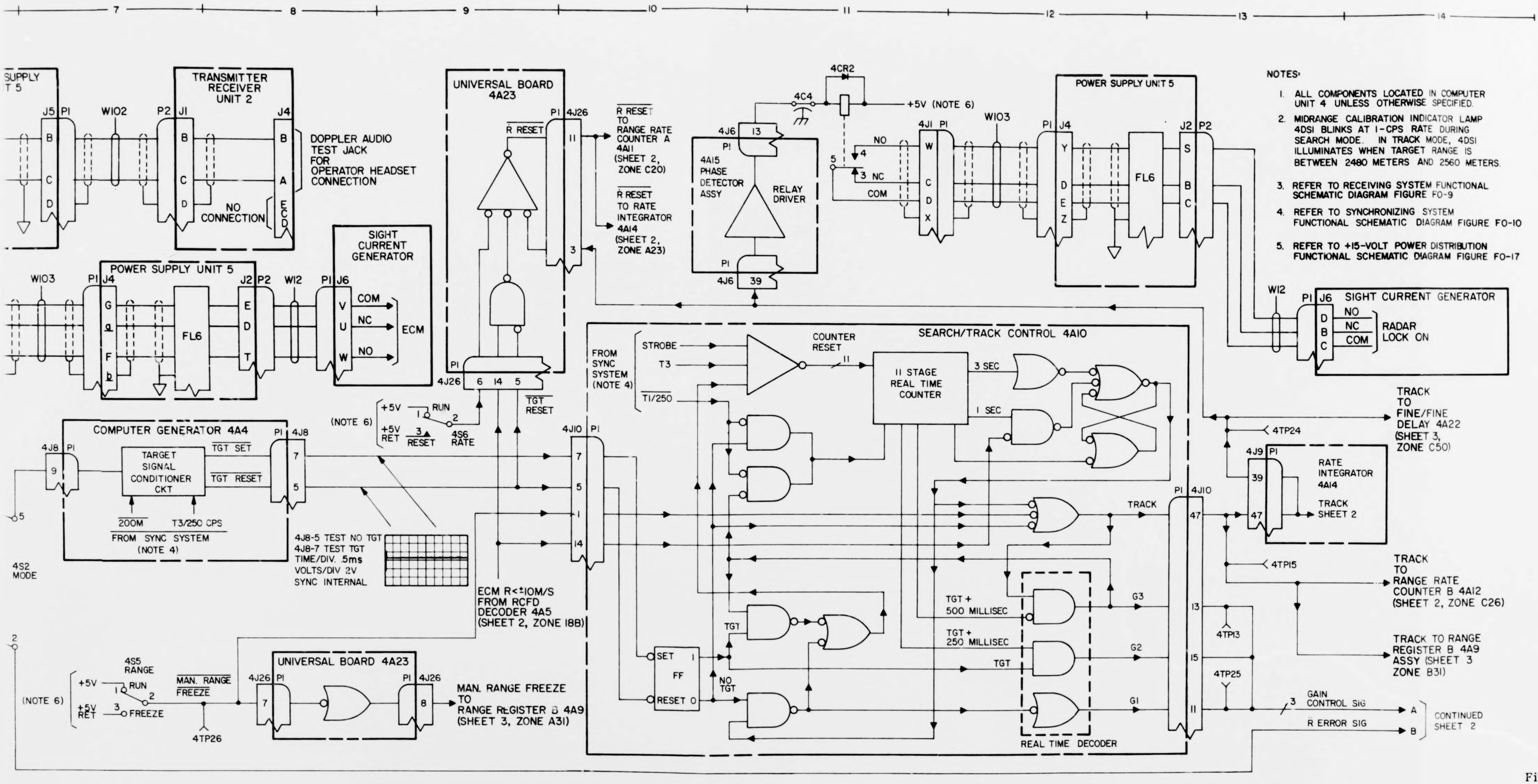
Figure FO-10. Computer unit 4 synchronizing system, functional schematic diagram (sheet 2 of 2)


1
2
3
4
5
6
A
B
C
D
CONTROL AMPLIFIER 4A21
TP1
AMPL
TP1
TP4
TEST
DOPPLER
AUDIO
R13
VOLUME
TP5
TP3
SUM
SIGNAL
STRENGTH
AC/DC
CONVERTER
CKT
P1
4J4
5
7
P1
4J7
43
41
49
4C5
4C6
4J1
P3
E
F
X
W103
P1
J4
k
m
S
POWE
U
RECEIVER UNIT 3
FROM
RECEIVING
SYSTEM
(NOTE 3)
DIFFERENCE
DOPPLER
AUDIO
SIGNAL
SUM
DOPPLER
AUDIO
SIGNAL
J2
G
A
F
P2
W105
4TP8
R<±10MS
FROM
RDFD DECODER 4A5
ASSY (SHEET 2
ZONE B18)
PHASE DETECTOR 4A15
4J6
P1
49
14
43
41
47
45
MAX SIGNAL
THRESHOLD
DETECTOR
MIN SIGNAL
THRESHOLD
DETECTOR
SUM
COMPARATOR
DIFFERENCE
COMPARATOR
RELAY
DRIVER
ECM
TGT DATA
Re ERROR SIG
P1
4J6
12
9
17
4C7
4K3
ECM
4CR4
+5V
(NOTE 6)
4J1
COM
NC
NO
5
3
4
B
A
V
X
4TP6
4TP7
NORM
TEST
(NOTE 6)
+5V
+5V
RET
1
TGT
2
3
NO TGT
4S4
RETURN
(NOTE 6)
+5V
+5V
RET
1
NEG
2
3
POS
4S3
ACCEL
P1 4J4
F
G
4TP47
4TP46
R3
C9
RET
SUM
DOPPLER
AUDIO
SIGNAL
4TP49
4TP48
R2
RET
DIFFERENCE
DOPPLER
AUDIO
SIGNAL

SUM CHANNEL
TP47 TO TP46
TIME/DIV 2ms
VOLT/DIV 20MV
NOTE LEVEL CAN
BE 180-280MV

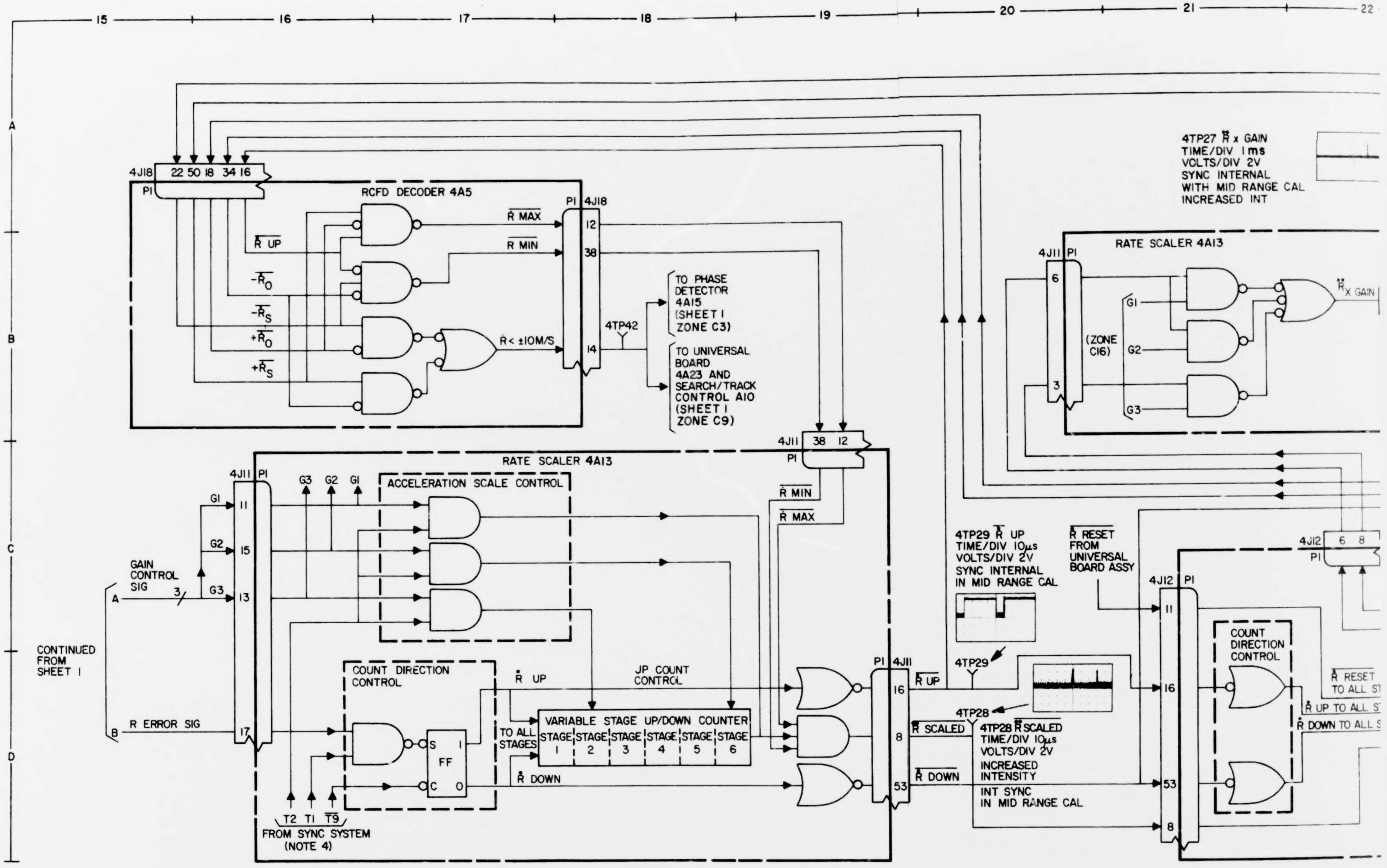
SUM CHANNEL NOISE
WITH MID RANGE CAL
DEPRESSED
TP47 TO TP46
TIME/DIV .5ms
VOLTS/DIV .1V
SYNC INT


7
8
9
10
11
12
13
14
SUPPLY
T 5
J5
P1
W102
P2
J1
J4
TRANSMITTER RECEIVER UNIT 2
B
C
D
A
E C D
NO CONNECTION
DOPPLER AUDIO TEST JACK FOR OPERATOR HEADSET CONNECTION
W103
POWER SUPPLY UNIT 5
G
a
F
b
FL6
E
D
T
W12
J6
V
U
W
COM
NC
NO
ECM
SIGHT CURRENT GENERATOR
UNIVERSAL BOARD 4A23
P1 4J26
R RESET
11
3
4J26
6
14
5
TGT RESET
R RESET TO RANGE RATE COUNTER A 4A11 (SHEET 2, ZONE C20)
R RESET TO RATE INTEGRATOR 4A14 (SHEET 2, ZONE A23)
(NOTE 6)
+5V
+5V RET
RUN
RESET
4S6 RATE
COMPUTER GENERATOR 4A4
4J8
9
TARGET SIGNAL CONDITIONER CKT
TGT SET
TGT RESET
200M
T3/250 CPS
FROM SYNC SYSTEM (NOTE 4)
4S2 MODE
4J8-5 TEST NO TGT
4J8-7 TEST TGT
TIME/DIV. .5ms
VOLTS/DIV 2V
SYNC INTERNAL
4J10
ECM R<±10M/S FROM RCFD DECODER 4A5 (SHEET 2, ZONE 18B)
4S5 RANGE
FREEZE
MAN. RANGE FREEZE
4TP26
7
8
MAN. RANGE FREEZE TO RANGE REGISTER B 4A9 (SHEET 3, ZONE A31)
4CR2
4C4
+5V (NOTE 6)
4J6
13
39
4A15 PHASE DETECTOR ASSY
RELAY DRIVER
NO
NC
COM
4J1 P1
W
C
D
X
W103
Y
D
E
Z
J2 P2
S
B
C
SEARCH/TRACK CONTROL 4A10
FROM SYNC SYSTEM (NOTE 4)
STROBE
T3
T1/250
COUNTER RESET
11 STAGE REAL TIME COUNTER
3 SEC
1 SEC
TGT
SET
FF
RESET
NO TGT
TGT + 500 MILLISEC
TGT + 250 MILLISEC
REAL TIME DECODER
G3
G2
G1
TRACK
47
13
15
4TP24
4TP15
4TP13
4TP25
TRACK TO FINE/FINE DELAY 4A22 (SHEET 3, ZONE C50)
4J9
RATE INTEGRATOR 4A14
TRACK SHEET 2
TRACK TO RANGE RATE COUNTER B 4A12 (SHEET 2, ZONE C26)
TRACK TO RANGE REGISTER B 4A9 ASSY (SHEET 3 ZONE B31)
GAIN CONTROL SIG
R ERROR SIG
A
B
CONTINUED SHEET 2
W12
SIGHT CURRENT GENERATOR
RADAR LOCK ON
ARR81 – 0424

NOTES:

1. ALL COMPONENTS LOCATED IN COMPUTER UNIT 4 UNLESS OTHERWISE SPECIFIED.
2. MIDRANGE CALIBRATION INDICATOR LAMP 4DS1 BLINKS AT 1-CPS RATE DURING SEARCH MODE. IN TRACK MODE, 4DS1 ILLUMINATES WHEN TARGET RANGE IS BETWEEN 2480 METERS AND 2560 METERS.
3. REFER TO RECEIVING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-9
4. REFER TO SYNCHRONIZING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-10
5. REFER TO +15-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-17
6. REFER TO +5-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-16
7. SYNC. ON 4J18-48 PULSE SHOULD MOVE FROM LEFT OR RIGHT IN STEPS. TIME/DIV 0.1MS.
8. SYNC. ON 4J18-42
   RFCD 1,2 & 3, TIME/DIV 0.2MS
   RFCD 4,5 & 6, TIME/DIV 1.0MS
   PULSES SHOULD MOVE FROM LEFT TO RIGHT IN STEPS.

Figure FO-11. Computer unit 4 ranging system, functional schematic diagram (sheet 1 of 4)


15
16
17
18
19
20
21
22
A
B
C
D
4J18
22 50 18 34 16
P1
RCFD DECODER 4A5
$\overline{R}$ UP
$-\overline{R_O}$
$-\overline{R_S}$
$+\overline{R_O}$
$+\overline{R_S}$
$\overline{R}$ MAX
R MIN
R< ±10M/S
P1 4J18
12
38
14
4TP42
TO PHASE DETECTOR 4A15 (SHEET 1 ZONE C3)
TO UNIVERSAL BOARD 4A23 AND SEARCH/TRACK CONTROL A10 (SHEET 1 ZONE C9)
4TP27 $\ddot{R}$ x GAIN
TIME/DIV 1ms
VOLTS/DIV 2V
SYNC INTERNAL
WITH MID RANGE CAL
INCREASED INT
RATE SCALER 4A13
4J11 P1
6
3
(ZONE C16)
G1
G2
G3
$\ddot{R}$X GAIN
4J11 38 12
P1
RATE SCALER 4A13
$\overline{R}$ MIN
$\overline{R}$ MAX
4J11 P1
11
15
13
17
G1
G2
G3
GAIN CONTROL SIG
A
3
B
R ERROR SIG
CONTINUED FROM SHEET 1
ACCELERATION SCALE CONTROL
COUNT DIRECTION CONTROL
S
C
FF
1
0
$\dot{R}$ UP
$\dot{R}$ DOWN
TO ALL STAGES
JP COUNT CONTROL
VARIABLE STAGE UP/DOWN COUNTER
STAGE 1
STAGE 2
STAGE 3
STAGE 4
STAGE 5
STAGE 6
T2 T1 $\overline{T9}$
FROM SYNC SYSTEM (NOTE 4)
P1 4J11
16
8
53
$\overline{R}$ UP
$\overline{R}$ SCALED
$\overline{R}$ DOWN
4TP29
4TP28
4TP29 $\overline{R}$ UP
TIME/DIV 10µs
VOLTS/DIV 2V
SYNC INTERNAL
IN MID RANGE CAL
4TP28 $\ddot{R}$ SCALED
TIME/DIV 10µs
VOLTS/DIV 2V
INCREASED INTENSITY
INT SYNC
IN MID RANGE CAL
$\overline{R}$ RESET FROM UNIVERSAL BOARD ASSY
4J12 P1
11
16
53
8
4J12 6 8
P1
COUNT DIRECTION CONTROL
$\overline{R}$ RESET TO ALL ST
$\dot{R}$ UP TO ALL ST
$\dot{R}$ DOWN TO ALL S

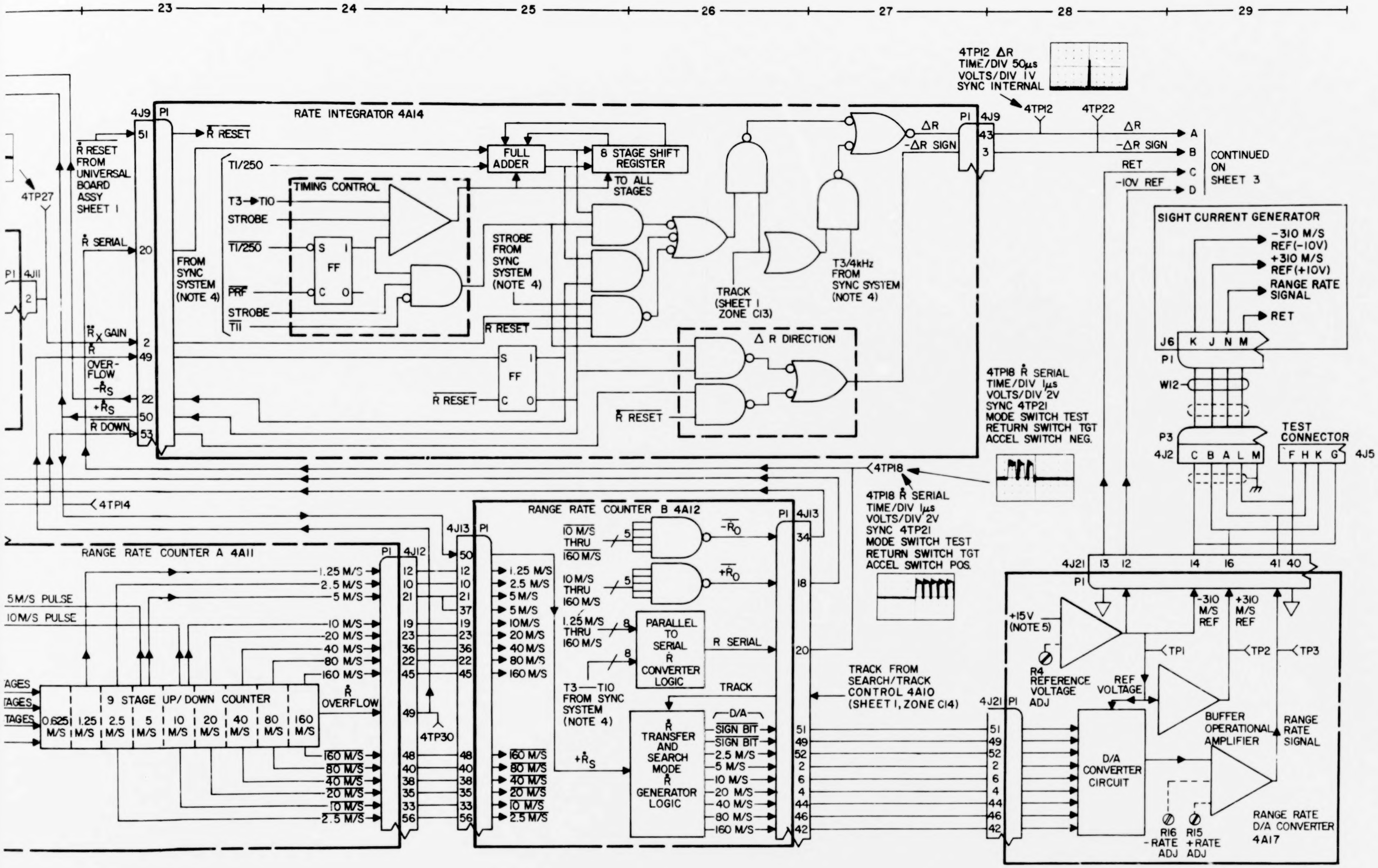

23
24
25
26
27
28
29
RATE INTEGRATOR 4A14
4J9
P1
51
20
2
49
22
50
53
Ṙ RESET
Ṙ RESET FROM UNIVERSAL BOARD ASSY SHEET 1
4TP27
Ṙ SERIAL
Ṙ_X GAIN
Ṙ OVER-FLOW
-Ṙ_S
+Ṙ_S
Ṙ DOWN
P1 4J11
FROM SYNC SYSTEM (NOTE 4)
T1/250
T3→T10
STROBE
T1/250
PRF
STROBE
T11
TIMING CONTROL
S 1
FF
C 0
FULL ADDER
8 STAGE SHIFT REGISTER
TO ALL STAGES
STROBE FROM SYNC SYSTEM (NOTE 4)
R RESET
Ṙ RESET
R RESET
TRACK (SHEET 1 ZONE C13)
T3/4kHz FROM SYNC SYSTEM (NOTE 4)
Δ R DIRECTION
ΔR
-ΔR SIGN
P1 4J9
43
3
4TP12 ΔR TIME/DIV 50μs VOLTS/DIV 1V SYNC INTERNAL
4TP12
4TP22
ΔR
-ΔR SIGN
RET
-10V REF
A
B
C
D
CONTINUED ON SHEET 3
SIGHT CURRENT GENERATOR
-310 M/S REF(-10V)
+310 M/S REF(+10V)
RANGE RATE SIGNAL
RET
J6
K J N M
P1
W12
P3
4J2
C B A L M
TEST CONNECTOR
F H K G
4J5
4TP18 Ṙ SERIAL TIME/DIV 1μs VOLTS/DIV 2V SYNC 4TP21 MODE SWITCH TEST RETURN SWITCH TGT ACCEL SWITCH NEG.
4TP18
4TP18 Ṙ SERIAL TIME/DIV 1μs VOLTS/DIV 2V SYNC 4TP21 MODE SWITCH TEST RETURN SWITCH TGT ACCEL SWITCH POS.
4TP14
RANGE RATE COUNTER A 4A11
5M/S PULSE
10M/S PULSE
AGES
TAGES
TAGES
1.25 M/S
2.5 M/S
5 M/S
10 M/S
20 M/S
40 M/S
80 M/S
160 M/S
Ṙ OVERFLOW
9 STAGE UP/DOWN COUNTER
0.625 M/S
1.25 M/S
2.5 M/S
5 M/S
10 M/S
20 M/S
40 M/S
80 M/S
160 M/S
160 M/S
80 M/S
40 M/S
20 M/S
10 M/S
2.5 M/S
P1 4J12
12
10
21
19
23
36
22
45
49
48
40
38
35
33
56
4TP30
4J13 P1
50
12
10
21
37
19
23
36
22
45
48
40
38
35
33
56
RANGE RATE COUNTER B 4A12
1.25 M/S
2.5 M/S
5 M/S
5 M/S
10M/S
20 M/S
40 M/S
80 M/S
160 M/S
160 M/S
80 M/S
40 M/S
20 M/S
10 M/S
2.5 M/S
10 M/S THRU 160 M/S
5
-Ṙ_O
10 M/S THRU 160 M/S
5
+Ṙ_O
1.25 M/S THRU 160 M/S
8
PARALLEL TO SERIAL Ṙ CONVERTER LOGIC
8
Ṙ SERIAL
T3—T10 FROM SYNC SYSTEM (NOTE 4)
TRACK
Ṙ TRANSFER AND SEARCH MODE Ṙ GENERATOR LOGIC
+Ṙ_S
D/A
SIGN BIT
SIGN BIT
2.5 M/S
5 M/S
10 M/S
20 M/S
40 M/S
80 M/S
160 M/S
P1 4J13
34
18
20
51
49
52
2
6
4
44
46
42
TRACK FROM SEARCH/TRACK CONTROL 4A10 (SHEET 1, ZONE C14)
4J21 P1
51
49
52
2
6
4
44
46
42
4J21
13
12
14
16
41
40
P1
+15V (NOTE 5)
R4 REFERENCE VOLTAGE ADJ
TP1
REF VOLTAGE
-310 M/S REF
+310 M/S REF
TP2
TP3
BUFFER OPERATIONAL AMPLIFIER
RANGE RATE SIGNAL
D/A CONVERTER CIRCUIT
R16 -RATE ADJ
R15 +RATE ADJ
RANGE RATE D/A CONVERTER 4A17
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Figure FO-11. Computer unit 4 ranging system, functional schematic diagram (sheet 2 of 4)

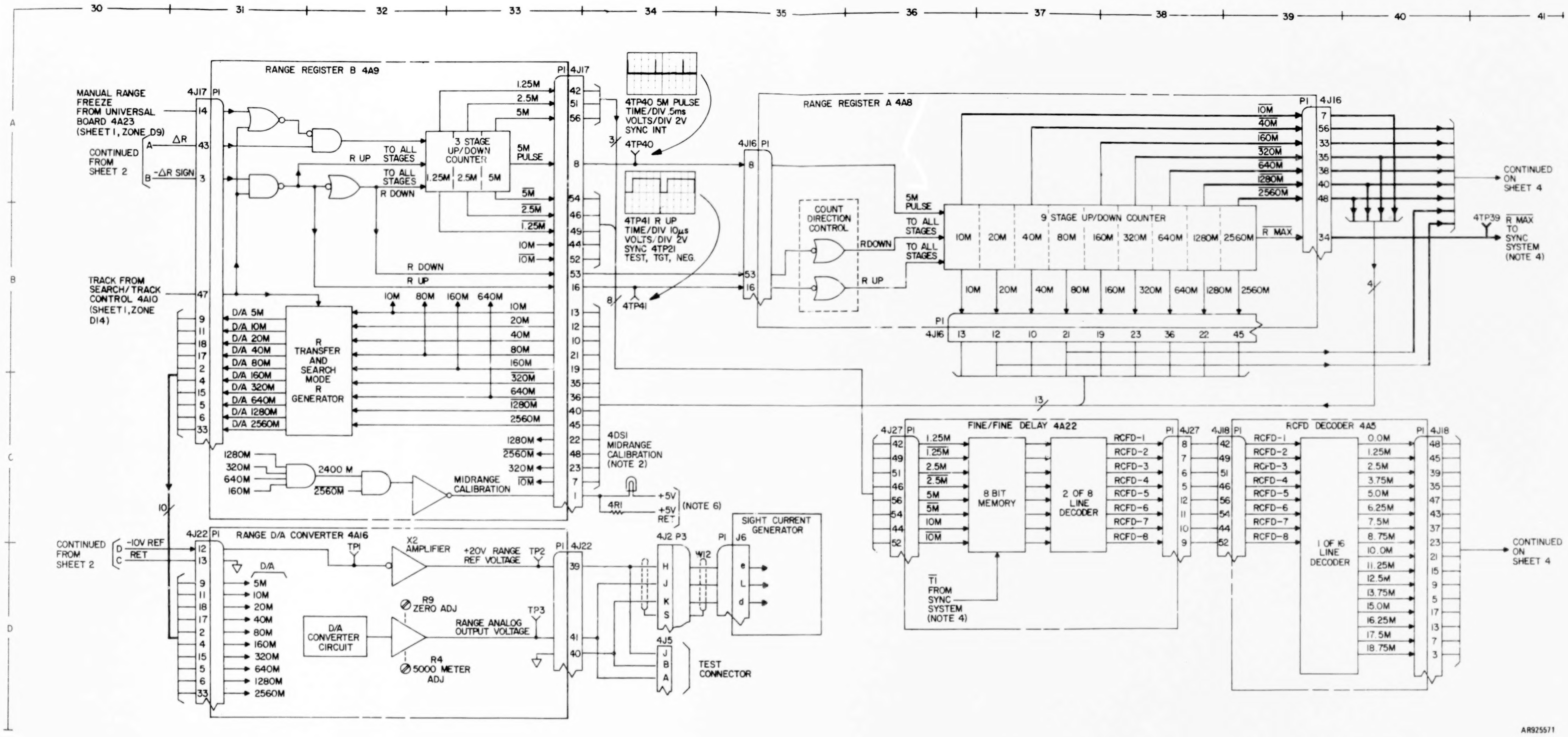
30
31
32
33
34
35
36
37
38
39
40
41
A
B
C
D
RANGE REGISTER B 4A9
MANUAL RANGE FREEZE FROM UNIVERSAL BOARD 4A23 (SHEET 1, ZONE D9)
CONTINUED FROM SHEET 2
ΔR
-ΔR SIGN
3 STAGE UP/DOWN COUNTER
TO ALL STAGES
R UP
R DOWN
5M PULSE
TRACK FROM SEARCH/TRACK CONTROL 4A10 (SHEET 1, ZONE D14)
R TRANSFER AND SEARCH MODE R GENERATOR
2400 M
MIDRANGE CALIBRATION
4TP40 5M PULSE TIME/DIV .5ms VOLTS/DIV 2V SYNC INT
4TP40
4TP41 R UP TIME/DIV 10µs VOLTS/DIV 2V SYNC 4TP21 TEST, TGT, NEG.
4TP41
4DS1 MIDRANGE CALIBRATION (NOTE 2)
4R1
+5V
+5V RET
(NOTE 6)
RANGE REGISTER A 4A8
COUNT DIRECTION CONTROL
RDOWN
R UP
9 STAGE UP/DOWN COUNTER
R MAX
4TP39
R MAX TO SYNC SYSTEM (NOTE 4)
CONTINUED ON SHEET 4
RANGE D/A CONVERTER 4A16
-10V REF
RET
X2 AMPLIFIER
+20V RANGE REF VOLTAGE
TP1
TP2
TP3
R9 ZERO ADJ
R4 5000 METER ADJ
D/A CONVERTER CIRCUIT
RANGE ANALOG OUTPUT VOLTAGE
4J2 P3
W12
SIGHT CURRENT GENERATOR
4J5
TEST CONNECTOR
FINE/FINE DELAY 4A22
8 BIT MEMORY
2 OF 8 LINE DECODER
T1 FROM SYNC SYSTEM (NOTE 4)
RCFD DECODER 4A5
1 OF 16 LINE DECODER
RCFD-1
RCFD-2
RCFD-3
RCFD-4
RCFD-5
RCFD-6
RCFD-7
RCFD-8
0.0M
1.25M
2.5M
3.75M
5.0M
6.25M
7.5M
8.75M
10.0M
11.25M
12.5M
13.75M
15.0M
16.25M
17.5M
18.75M
CONTINUED ON SHEET 4
AR925571

Figure FO-11. Computer unit 4 ranging system, functional schematic diagram (sheet 3 of 4)

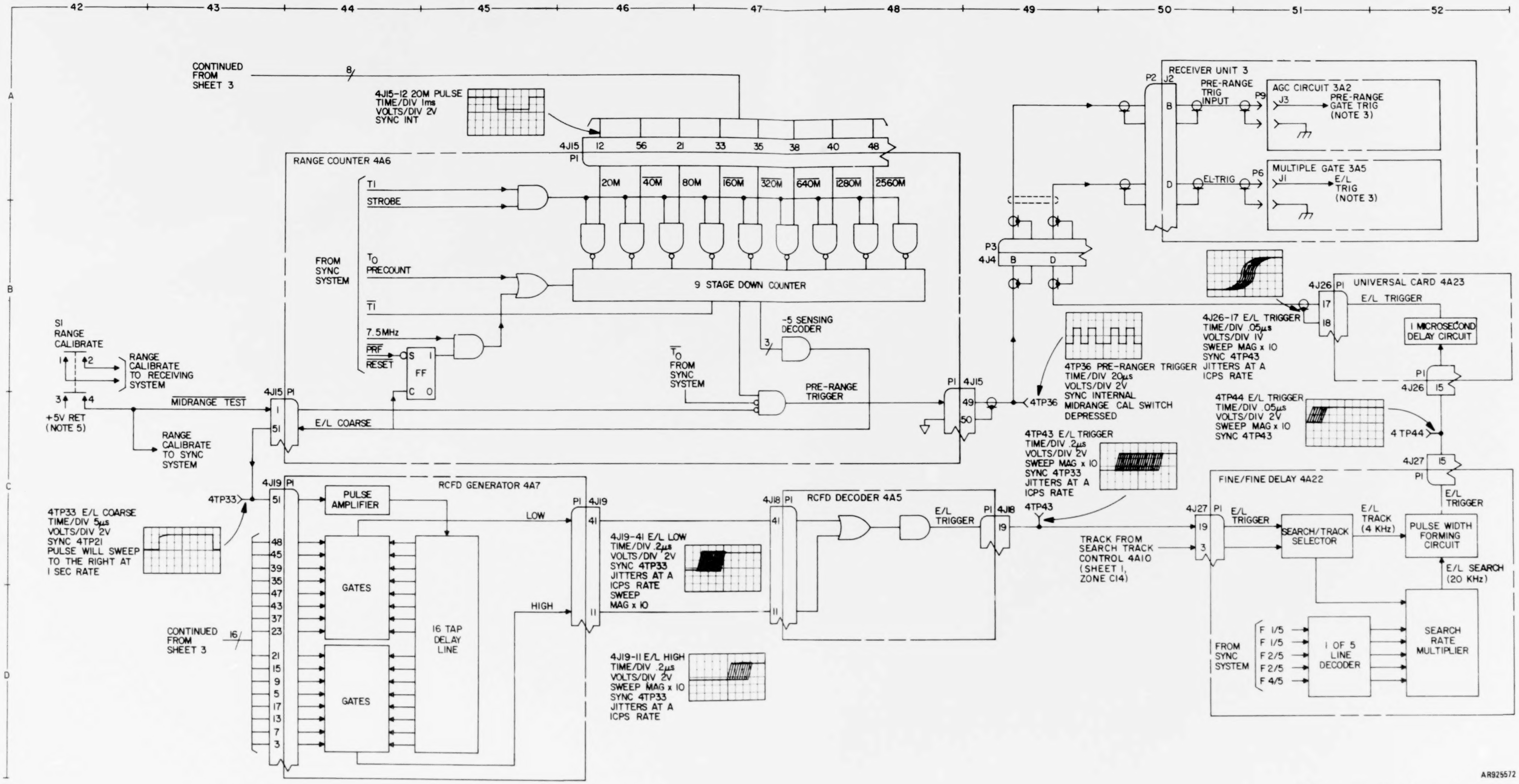
42
43
44
45
46
47
48
49
50
51
52
A
B
C
D
CONTINUED FROM SHEET 3
8
4J15-12 20M PULSE TIME/DIV 1ms VOLTS/DIV 2V SYNC INT
4J15
P1
12
56
21
33
35
38
40
48
RANGE COUNTER 4A6
T1
STROBE
20M
40M
80M
160M
320M
640M
1280M
2560M
FROM SYNC SYSTEM
T0 PRECOUNT
9 STAGE DOWN COUNTER
T1
7.5MHz
PRF
RESET
S
1
FF
C
0
-5 SENSING DECODER
3
T0 FROM SYNC SYSTEM
PRE-RANGE TRIGGER
S1 RANGE CALIBRATE
1
2
3
4
RANGE CALIBRATE TO RECEIVING SYSTEM
MIDRANGE TEST
+5V RET (NOTE 5)
RANGE CALIBRATE TO SYNC SYSTEM
4J15
P1
1
51
E/L COARSE
P1
4J15
49
50
4TP36
RECEIVER UNIT 3
P2
J2
B
D
PRE-RANGE TRIG INPUT
P9
AGC CIRCUIT 3A2
J3
PRE-RANGE GATE TRIG (NOTE 3)
EL-TRIG
P6
MULTIPLE GATE 3A5
J1
E/L TRIG (NOTE 3)
P3
4J4
B
D
4TP36 PRE-RANGER TRIGGER TIME/DIV 20µs VOLTS/DIV 2V SYNC INTERNAL MIDRANGE CAL SWITCH DEPRESSED
4J26-17 E/L TRIGGER TIME/DIV .05µs VOLTS/DIV 1V SWEEP MAG x 10 SYNC 4TP43 JITTERS AT A ICPS RATE
4J26
P1
17
18
UNIVERSAL CARD 4A23
E/L TRIGGER
1 MICROSECOND DELAY CIRCUIT
P1
4J26
15
4TP44 E/L TRIGGER TIME/DIV .05µs VOLTS/DIV 2V SWEEP MAG x 10 SYNC 4TP43
4TP44
4J27
P1
15
4TP43 E/L TRIGGER TIME/DIV .2µs VOLTS/DIV 2V SWEEP MAG x 10 SYNC 4TP33 JITTERS AT A ICPS RATE
4TP43
4TP33
4TP33 E/L COARSE TIME/DIV 5µs VOLTS/DIV 2V SYNC 4TP21 PULSE WILL SWEEP TO THE RIGHT AT 1 SEC RATE
4J19
P1
51
48
45
39
35
47
43
37
23
21
15
9
5
17
13
7
3
CONTINUED FROM SHEET 3
16
RCFD GENERATOR 4A7
PULSE AMPLIFIER
GATES
GATES
16 TAP DELAY LINE
LOW
HIGH
P1
4J19
41
11
4J19-41 E/L LOW TIME/DIV .2µs VOLTS/DIV 2V SYNC 4TP33 JITTERS AT A ICPS RATE SWEEP MAG x 10
4J19-11 E/L HIGH TIME/DIV .2µs VOLTS/DIV 2V SWEEP MAG x 10 SYNC 4TP33 JITTERS AT A ICPS RATE
4J18
P1
41
11
RCFD DECODER 4A5
E/L TRIGGER
P1
4J18
19
TRACK FROM SEARCH TRACK CONTROL 4A10 (SHEET 1, ZONE C14)
FINE/FINE DELAY 4A22
4J27
P1
19
3
E/L TRIGGER
SEARCH/TRACK SELECTOR
E/L TRACK (4 KHz)
PULSE WIDTH FORMING CIRCUIT
E/L TRIGGER
E/L SEARCH (20 KHz)
FROM SYNC SYSTEM
F 1/5
F 1/5
F 2/5
F 2/5
F 4/5
1 OF 5 LINE DECODER
SEARCH RATE MULTIPLIER

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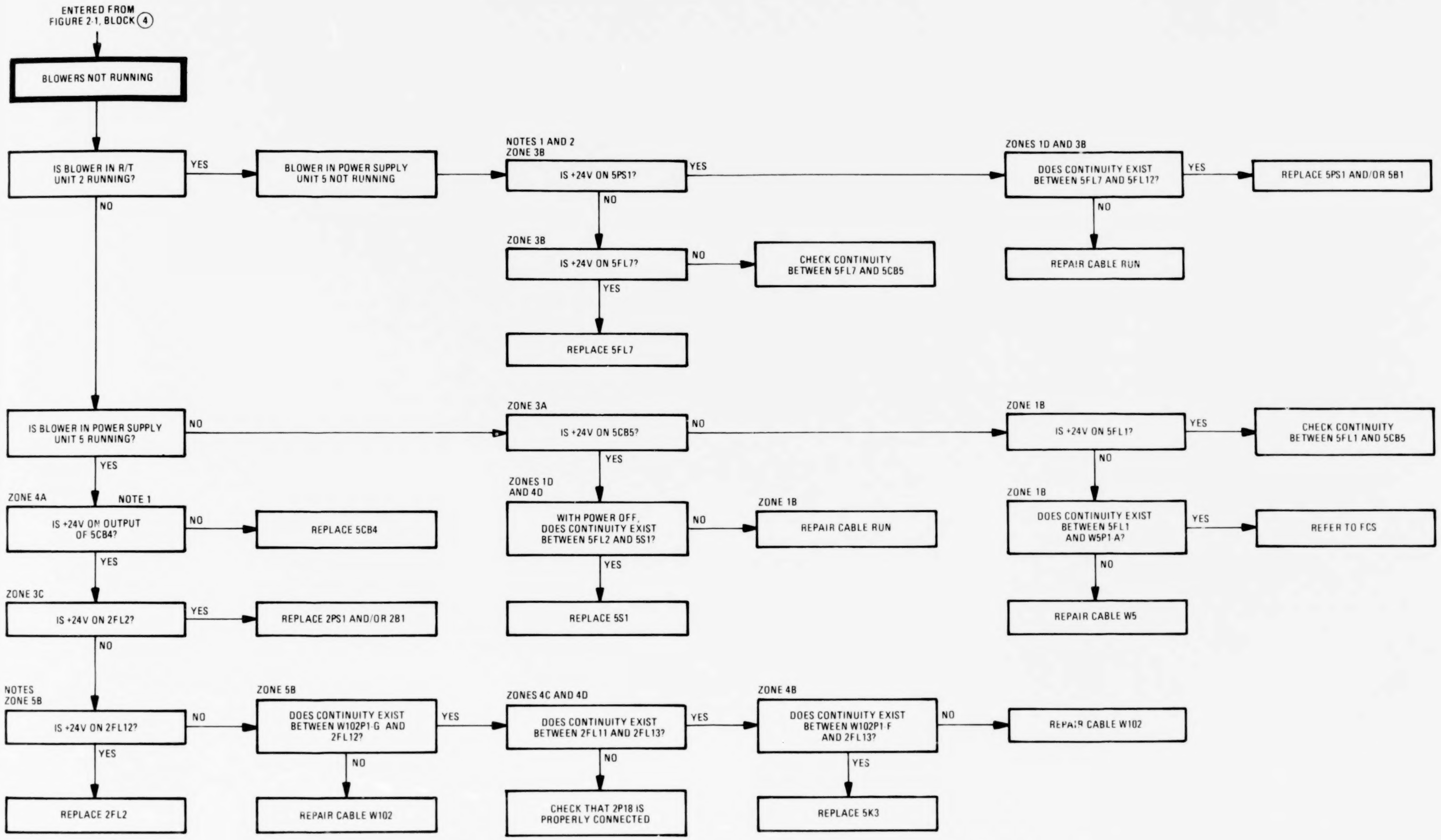
Figure FO-11. Computer unit 4 ranging system, functional schematic diagram (sheet 4 of 4)


ENTERED FROM
FIGURE 2-1, BLOCK ④
BLOWERS NOT RUNNING
IS BLOWER IN R/T UNIT 2 RUNNING?
YES
NO
BLOWER IN POWER SUPPLY UNIT 5 NOT RUNNING
NOTES 1 AND 2
ZONE 3B
IS +24V ON 5PS1?
YES
NO
ZONES 1D AND 3B
DOES CONTINUITY EXIST BETWEEN 5FL7 AND 5FL12?
YES
REPLACE 5PS1 AND/OR 5B1
NO
REPAIR CABLE RUN
ZONE 3B
IS +24V ON 5FL7?
NO
CHECK CONTINUITY BETWEEN 5FL7 AND 5CB5
YES
REPLACE 5FL7
IS BLOWER IN POWER SUPPLY UNIT 5 RUNNING?
NO
ZONE 3A
IS +24V ON 5CB5?
NO
ZONE 1B
IS +24V ON 5FL1?
YES
CHECK CONTINUITY BETWEEN 5FL1 AND 5CB5
NO
ZONE 1B
DOES CONTINUITY EXIST BETWEEN 5FL1 AND W5P1 A?
YES
REFER TO FCS
NO
REPAIR CABLE W5
YES
ZONES 1D AND 4D
WITH POWER OFF, DOES CONTINUITY EXIST BETWEEN 5FL2 AND 5S1?
NO
ZONE 1B
REPAIR CABLE RUN
YES
REPLACE 5S1
YES
ZONE 4A
NOTE 1
IS +24V ON OUTPUT OF 5CB4?
NO
REPLACE 5CB4
YES
ZONE 3C
IS +24V ON 2FL2?
YES
REPLACE 2PS1 AND/OR 2B1
NO
NOTES
ZONE 5B
IS +24V ON 2FL12?
YES
REPLACE 2FL2
NO
ZONE 5B
DOES CONTINUITY EXIST BETWEEN W102P1-G AND 2FL12?
NO
REPAIR CABLE W102
YES
ZONES 4C AND 4D
DOES CONTINUITY EXIST BETWEEN 2FL11 AND 2FL13?
NO
CHECK THAT 2P18 IS PROPERLY CONNECTED
YES
ZONE 4B
DOES CONTINUITY EXIST BETWEEN W102P1-F AND 2FL13?
NO
REPAIR CABLE W102
YES
REPLACE 5K3

NOTES:

1. ZONE NUMBERS REFER TO LOCATION ON FIGURE FO-14.
2. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 3-4.
3. REFER TO COMPONENT LOCATION DIAGRAM FIGURE 7-6.

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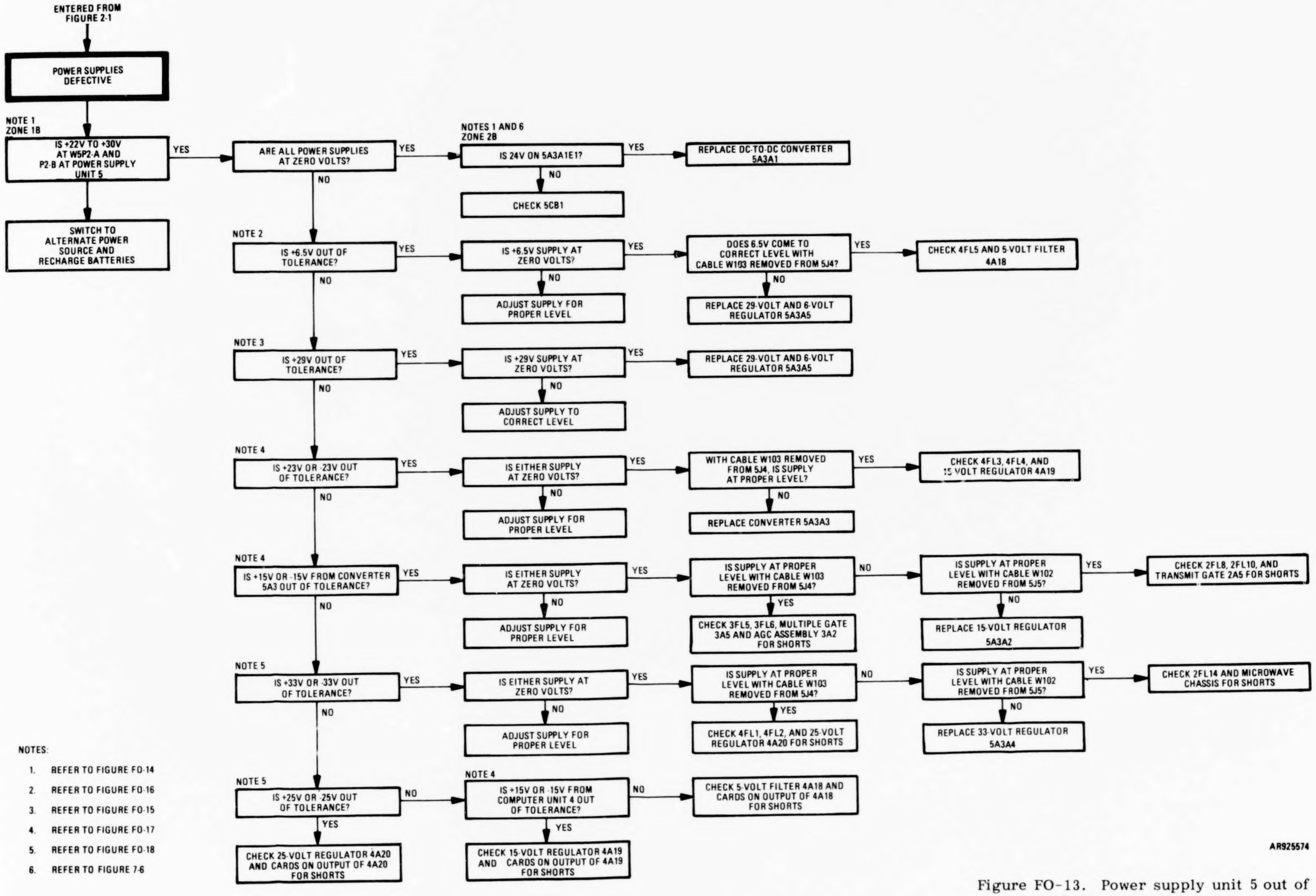
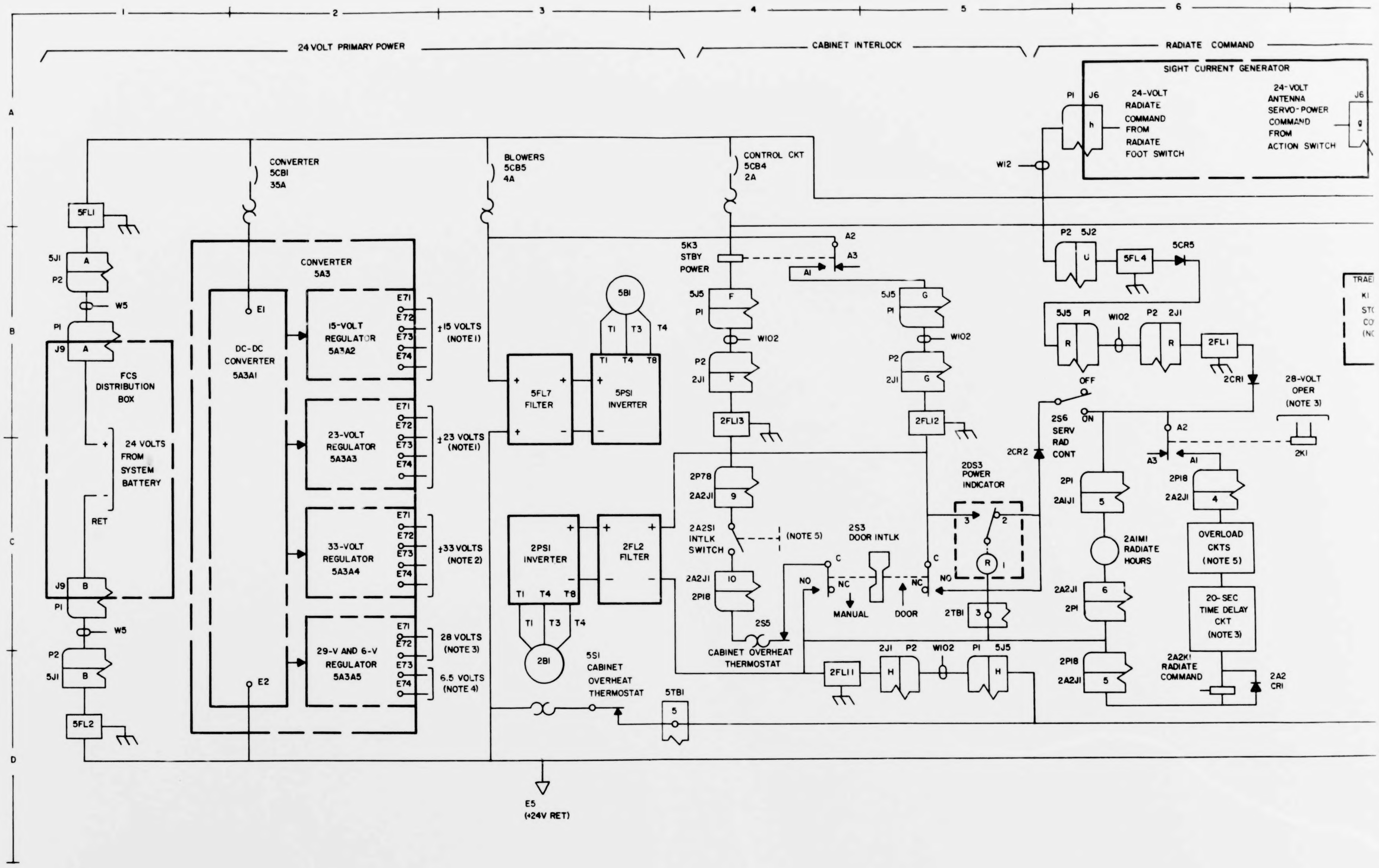
Figure FO-12. Power supply unit 5 and receiver/transmitter unit 2 blowers, fault localization diagram

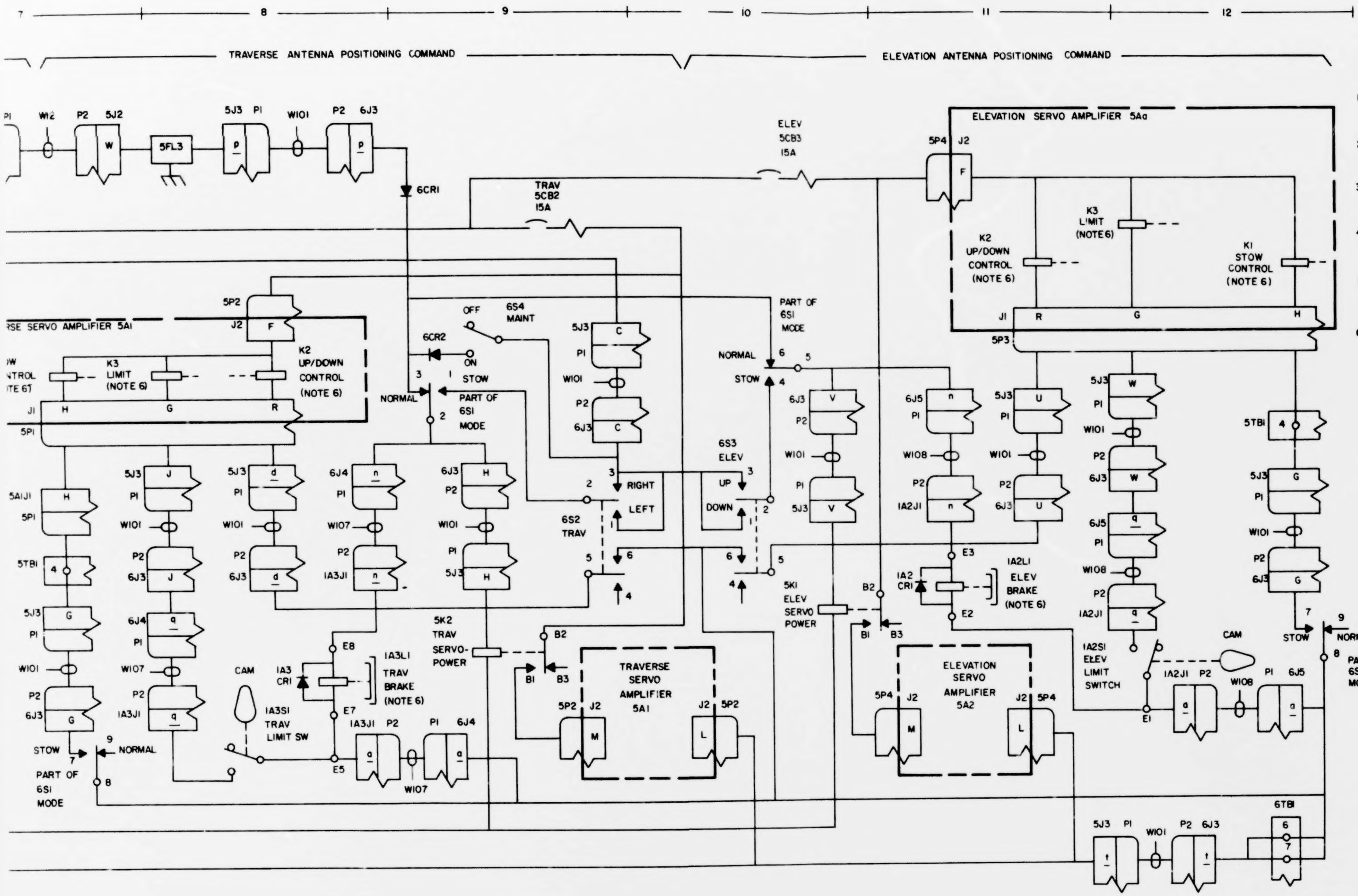

ENTERED FROM FIGURE 2-1
POWER SUPPLIES DEFECTIVE
NOTE 1 ZONE 1B
IS +22V TO +30V AT W5P2-A AND P2-B AT POWER SUPPLY UNIT 5
YES
NO
SWITCH TO ALTERNATE POWER SOURCE AND RECHARGE BATTERIES
ARE ALL POWER SUPPLIES AT ZERO VOLTS?
YES
NO
NOTES 1 AND 6 ZONE 2B
IS 24V ON 5A3A1E1?
YES
REPLACE DC-TO-DC CONVERTER 5A3A1
NO
CHECK 5CB1
NOTE 2
IS +6.5V OUT OF TOLERANCE?
YES
NO
IS +6.5V SUPPLY AT ZERO VOLTS?
YES
NO
ADJUST SUPPLY FOR PROPER LEVEL
DOES 6.5V COME TO CORRECT LEVEL WITH CABLE W103 REMOVED FROM 5J4?
YES
CHECK 4FL5 AND 5-VOLT FILTER 4A18
NO
REPLACE 29-VOLT AND 6-VOLT REGULATOR 5A3A5
NOTE 3
IS +29V OUT OF TOLERANCE?
YES
NO
IS +29V SUPPLY AT ZERO VOLTS?
YES
REPLACE 29-VOLT AND 6-VOLT REGULATOR 5A3A5
NO
ADJUST SUPPLY TO CORRECT LEVEL
NOTE 4
IS +23V OR -23V OUT OF TOLERANCE?
YES
NO
IS EITHER SUPPLY AT ZERO VOLTS?
YES
NO
ADJUST SUPPLY FOR PROPER LEVEL
WITH CABLE W103 REMOVED FROM 5J4, IS SUPPLY AT PROPER LEVEL?
YES
CHECK 4FL3, 4FL4, AND 15-VOLT REGULATOR 4A19
NO
REPLACE CONVERTER 5A3A3
NOTE 4
IS +15V OR -15V FROM CONVERTER 5A3 OUT OF TOLERANCE?
YES
NO
IS EITHER SUPPLY AT ZERO VOLTS?
YES
NO
ADJUST SUPPLY FOR PROPER LEVEL
IS SUPPLY AT PROPER LEVEL WITH CABLE W103 REMOVED FROM 5J4?
NO
YES
CHECK 3FL5, 3FL6, MULTIPLE GATE 3A5 AND AGC ASSEMBLY 3A2 FOR SHORTS
IS SUPPLY AT PROPER LEVEL WITH CABLE W102 REMOVED FROM 5J5?
YES
CHECK 2FL8, 2FL10, AND TRANSMIT GATE 2A5 FOR SHORTS
NO
REPLACE 15-VOLT REGULATOR 5A3A2
NOTE 5
IS +33V OR -33V OUT OF TOLERANCE?
YES
NO
IS EITHER SUPPLY AT ZERO VOLTS?
YES
NO
ADJUST SUPPLY FOR PROPER LEVEL
IS SUPPLY AT PROPER LEVEL WITH CABLE W103 REMOVED FROM 5J4?
NO
YES
CHECK 4FL1, 4FL2, AND 25-VOLT REGULATOR 4A20 FOR SHORTS
IS SUPPLY AT PROPER LEVEL WITH CABLE W102 REMOVED FROM 5J5?
YES
CHECK 2FL14 AND MICROWAVE CHASSIS FOR SHORTS
NO
REPLACE 33-VOLT REGULATOR 5A3A4
NOTE 5
IS +25V OR -25V OUT OF TOLERANCE?
NO
YES
CHECK 25-VOLT REGULATOR 4A20 AND CARDS ON OUTPUT OF 4A20 FOR SHORTS
NOTE 4
IS +15V OR -15V FROM COMPUTER UNIT 4 OUT OF TOLERANCE?
NO
CHECK 5-VOLT FILTER 4A18 AND CARDS ON OUTPUT OF 4A18 FOR SHORTS
YES
CHECK 15-VOLT REGULATOR 4A19 AND CARDS ON OUTPUT OF 4A19 FOR SHORTS
AR925574

NOTES:

1. REFER TO FIGURE FO-14
2. REFER TO FIGURE FO-16
3. REFER TO FIGURE FO-15
4. REFER TO FIGURE FO-17
5. REFER TO FIGURE FO-18
6. REFER TO FIGURE 7-6

Figure FO-13. Power supply unit 5 out of tolerance measurements, fault localization diagram


1
2
3
4
5
6
A
B
C
D
24 VOLT PRIMARY POWER
CABINET INTERLOCK
RADIATE COMMAND
SIGHT CURRENT GENERATOR
P1
J6
h
24-VOLT RADIATE COMMAND FROM RADIATE FOOT SWITCH
24-VOLT ANTENNA SERVO-POWER COMMAND FROM ACTION SWITCH
J6
g
W12
CONVERTER 5CB1 35A
BLOWERS 5CB5 4A
CONTROL CKT 5CB4 2A
5FL1
5J1
A
P2
W5
P1
J9
A
FCS DISTRIBUTION BOX
24 VOLTS FROM SYSTEM BATTERY
+
-
RET
J9
B
P1
W5
P2
5J1
B
5FL2
CONVERTER 5A3
E1
DC-DC CONVERTER 5A3A1
E2
15-VOLT REGULATOR 5A3A2
23-VOLT REGULATOR 5A3A3
33-VOLT REGULATOR 5A3A4
29-V AND 6-V REGULATOR 5A3A5
E71
E72
E73
E74
±15 VOLTS (NOTE 1)
±23 VOLTS (NOTE 1)
±33 VOLTS (NOTE 2)
28 VOLTS (NOTE 3)
6.5 VOLTS (NOTE 4)
5B1
T1
T3
T4
T8
5FL7 FILTER
5PS1 INVERTER
2PS1 INVERTER
2FL2 FILTER
2B1
5S1 CABINET OVERHEAT THERMOSTAT
5TB1
5
E5 (+24V RET)
5K3 STBY POWER
A1
A2
A3
5J5
F
P1
W102
P2
2J1
F
2FL13
5J5
G
P1
W102
P2
2J1
G
2FL12
2P78
2A2J1
9
2A2S1 INTLK SWITCH
(NOTE 5)
2A2J1
10
2P18
2S5 CABINET OVERHEAT THERMOSTAT
2S3 DOOR INTLK
C
NO
NC
MANUAL
DOOR
NC
C
NO
2DS3 POWER INDICATOR
3
2
R
1
2TB1
3
2FL11
2J1
P2
W102
P1
5J5
H
H
P2
5J2
U
5FL4
5CR5
5J5
P1
W102
P2
2J1
R
R
2FL1
2CR1
OFF
2S6 SERV RAD CONT
ON
2CR2
28-VOLT OPER (NOTE 3)
A2
A3
A1
2K1
2P1
2A1J1
5
2A1M1 RADIATE HOURS
2A2J1
6
2P1
2P18
2A2J1
5
2P18
2A2J1
4
OVERLOAD CKTS (NOTE 5)
20-SEC TIME DELAY CKT (NOTE 3)
2A2K1 RADIATE COMMAND
2A2 CR1
TRAE
K1
STC
CO
(NC


7
8
9
10
11
12
TRAVERSE ANTENNA POSITIONING COMMAND
ELEVATION ANTENNA POSITIONING COMMAND
W12
P2 5J2
5FL3
5J3 P1
W101
P2 6J3
6CR1
TRAV 5CB2 15A
ELEV 5CB3 15A
ELEVATION SERVO AMPLIFIER 5A2
5P4 J2
K2 UP/DOWN CONTROL (NOTE 6)
K3 LIMIT (NOTE 6)
K1 STOW CONTROL (NOTE 6)
J1
5P3
5P2
J2
SE SERVO AMPLIFIER 5A1
K3 LIMIT (NOTE 6)
K2 UP/DOWN CONTROL (NOTE 6)
5P1
OFF
6S4 MAINT
ON
STOW
6CR2
NORMAL
PART OF 6S1 MODE
6S3 ELEV
UP
DOWN
6S2 TRAV
RIGHT
LEFT
5K2 TRAV SERVO-POWER
5K1 ELEV SERVO POWER
1A3L1 TRAV BRAKE (NOTE 6)
1A3 CR1
1A3S1 TRAV LIMIT SW
CAM
TRAVERSE SERVO AMPLIFIER 5A1
ELEVATION SERVO AMPLIFIER 5A2
1A2L1 ELEV BRAKE (NOTE 6)
1A2 CR1
1A2S1 ELEV LIMIT SWITCH
5TB1
6TB1
STOW
NORMAL
PART OF 6S1 MODE

1. REFER TO 23-VOLT AND 15-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-17.
2. REFER TO 33-VOLT AND 25-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-18.
3. REFER TO 28-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-15.
4. REFER TO 6.5 VOLT AND 5-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-16.
5. REFER TO TRANSMITTING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-8.
6. REFER TO ANTENNA POSITIONING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-5.

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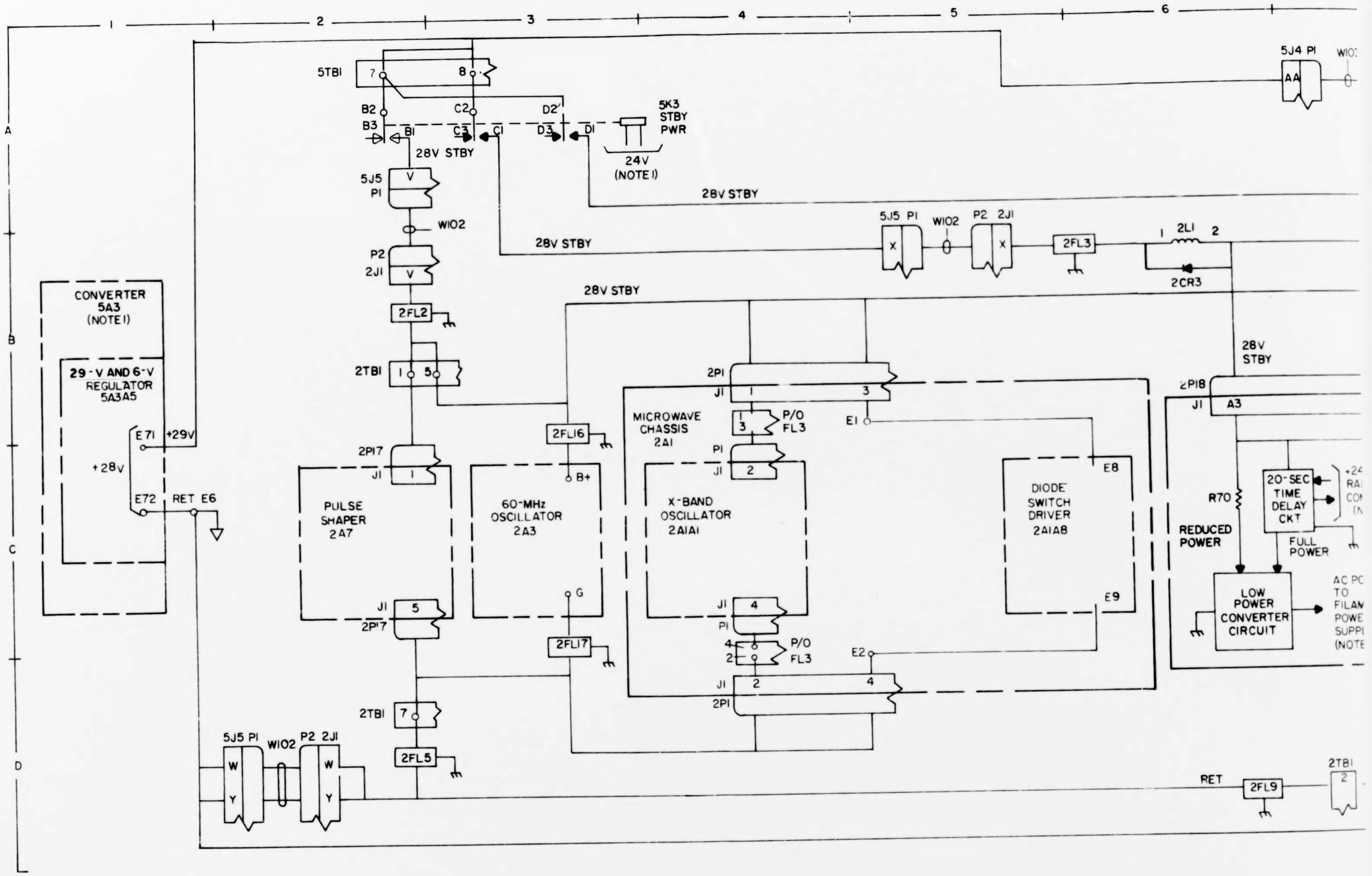
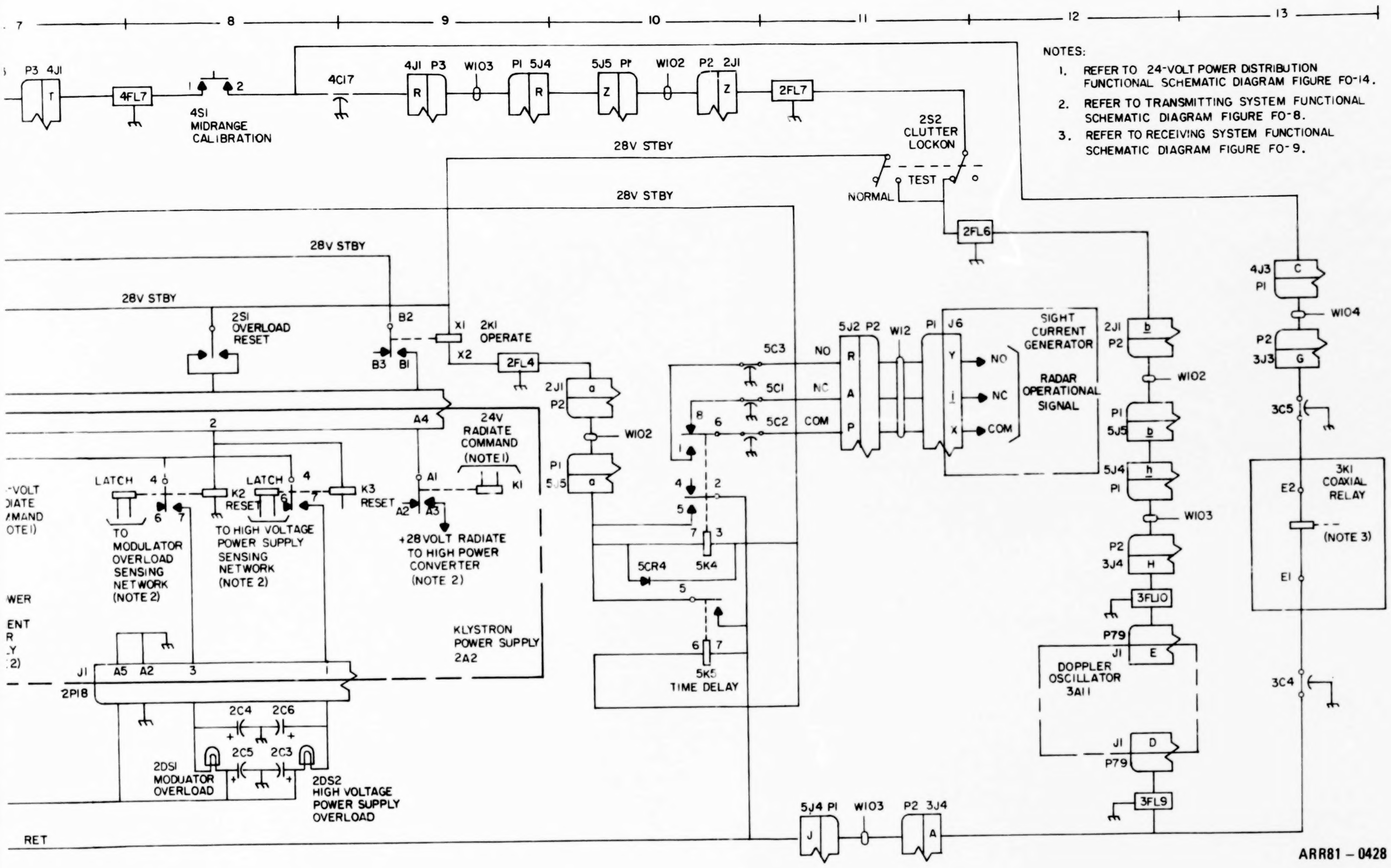
Figure FO-14. +24-volt power distribution, functional schematic diagram


1
2
3
4
5
6
A
B
C
D
5TBI
7
8
B2
B3
BI
C2
C3
CI
D2
D3
DI
5K3
STBY
PWR
24V
(NOTE I)
28V STBY
5J5
PI
V
WI02
P2
2JI
2FL2
2TBI
1
5
2PI7
JI
CONVERTER
5A3
(NOTE I)
29-V AND 6-V
REGULATOR
5A3A5
E7I
+29V
+28V
E72
RET
E6
PULSE
SHAPER
2A7
60-MHz
OSCILLATOR
2A3
2FLI6
B+
G
2FLI7
2TBI
7
2FL5
5J5 PI
WI02
P2 2JI
W
Y
5J4 PI
AA
WI0
X
2FL3
2LI
2CR3
28V
STBY
2PI
3
MICROWAVE
CHASSIS
2AI
EI
P/O
FL3
X-BAND
OSCILLATOR
2AIAI
4
2
DIODE
SWITCH
DRIVER
2AIA8
E8
E9
E2
2PI8
A3
R70
REDUCED
POWER
20-SEC
TIME
DELAY
CKT
FULL
POWER
+24
RA
CO
(N
LOW
POWER
CONVERTER
CIRCUIT
AC PO
TO
FILAM
POWE
SUPPI
(NOTE
RET
2FL9


7
8
9
10
11
12
13
P3 4JI
T
4FL7
4SI MIDRANGE CALIBRATION
4C17
4JI P3
R
WI03
PI 5J4
5J5 PI
Z
WI02
P2 2JI
2FL7
2S2 CLUTTER LOCKON
NORMAL
TEST
28V STBY
28V STBY
2FL6
28V STBY
28V STBY
2SI OVERLOAD RESET
B2
B3
BI
XI
2KI OPERATE
X2
2FL4
2JI
P2
a
WI02
PI
5J5
A4
2
24V RADIATE COMMAND (NOTE I)
KI
AI
A2
A3
LATCH
K2 RESET
K3 RESET
TO MODULATOR OVERLOAD SENSING NETWORK (NOTE 2)
TO HIGH VOLTAGE POWER SUPPLY SENSING NETWORK (NOTE 2)
+28 VOLT RADIATE TO HIGH POWER CONVERTER (NOTE 2)
KLYSTRON POWER SUPPLY 2A2
-VOLT
DIATE
MAND
OTE I)
WER
ENT
R
Y
2)
JI
A5
A2
3
I
2PI8
2C4
2C6
2C5
2C3
2DSI MODUATOR OVERLOAD
2DS2 HIGH VOLTAGE POWER SUPPLY OVERLOAD
RET
5C3
5CI
5C2
NO
NC
COM
5J2 P2
WI2
PI J6
R
A
P
Y
i
X
SIGHT CURRENT GENERATOR
RADAR OPERATIONAL SIGNAL
5CR4
5K4
5K5 TIME DELAY
2JI
P2
b
PI
5J5
5J4
PI
h
WI03
P2
3J4
H
3FLIO
P79
JI
E
DOPPLER OSCILLATOR 3AII
D
3FL9
5J4 PI
J
WI03
P2 3J4
A
4J3
PI
C
WI04
P2
3J3
G
3C5
3KI COAXIAL RELAY
E2
EI
(NOTE 3)
3C4
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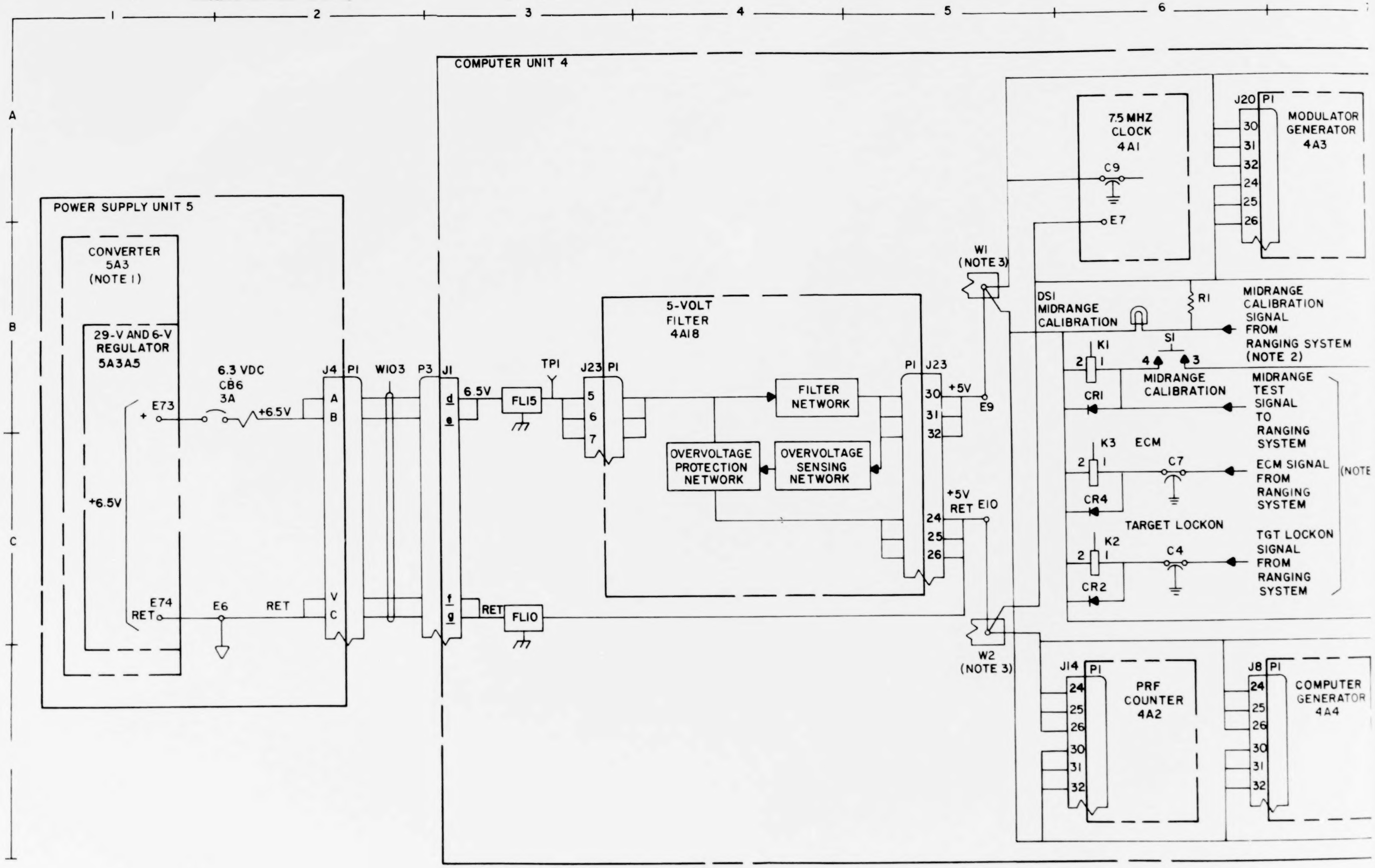
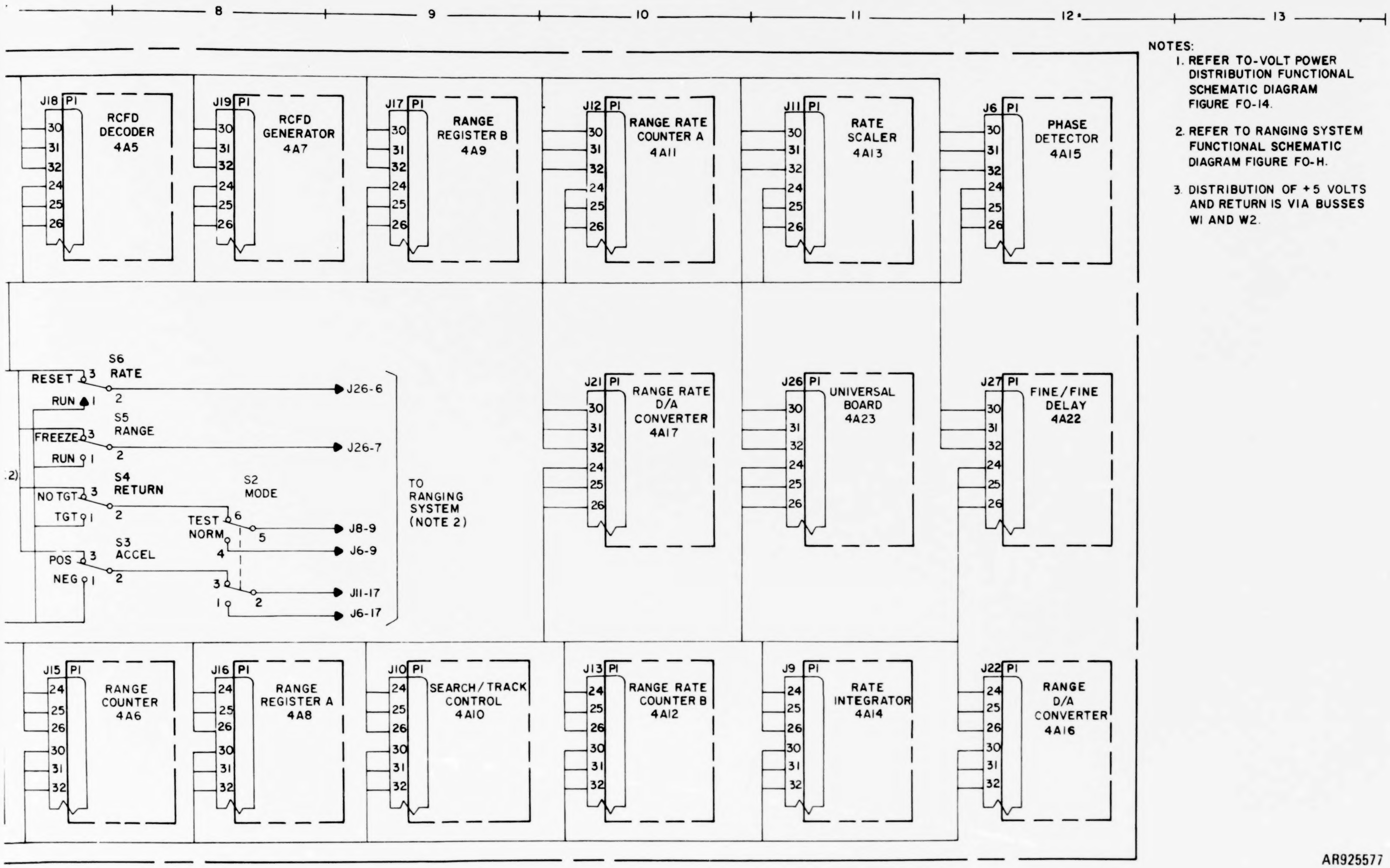
NOTES:

1. REFER TO 24-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-14.
2. REFER TO TRANSMITTING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-8.
3. REFER TO RECEIVING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-9.

Figure FO-15. +28-volt power distribution, functional schematic diagram

1
2
3
4
5
6
A
B
C
COMPUTER UNIT 4
POWER SUPPLY UNIT 5
CONVERTER 5A3 (NOTE 1)
29-V AND 6-V REGULATOR 5A3A5
+6.5V
+ E73
E74 RET
E6
RET
6.3 VDC CB6 3A
+6.5V
J4 P1
A
B
V
C
W103
P3 J1
d
e
f
g
6.5V
RET
FL15
FL10
TP1
J23 P1
5
6
7
5-VOLT FILTER 4A18
FILTER NETWORK
OVERVOLTAGE PROTECTION NETWORK
OVERVOLTAGE SENSING NETWORK
P1 J23
30
31
32
24
25
26
+5V
E9
+5V RET E10
W1 (NOTE 3)
W2 (NOTE 3)
7.5 MHZ CLOCK 4A1
C9
E7
J20 P1
30
31
32
24
25
26
MODULATOR GENERATOR 4A3
DS1 MIDRANGE CALIBRATION
R1
MIDRANGE CALIBRATION SIGNAL FROM RANGING SYSTEM (NOTE 2)
K1
2
1
S1
4
3
MIDRANGE CALIBRATION
CR1
MIDRANGE TEST SIGNAL TO RANGING SYSTEM
K3
ECM
C7
ECM SIGNAL FROM RANGING SYSTEM
CR4
(NOTE
TARGET LOCKON
K2
C4
TGT LOCKON SIGNAL FROM RANGING SYSTEM
CR2
J14 P1
24
25
26
30
31
32
PRF COUNTER 4A2
J8 P1
24
25
26
30
31
32
COMPUTER GENERATOR 4A4


8
9
10
11
12
13
J18 P1 RCFD DECODER 4A5
J19 P1 RCFD GENERATOR 4A7
J17 P1 RANGE REGISTER B 4A9
J12 P1 RANGE RATE COUNTER A 4A11
J11 P1 RATE SCALER 4A13
J6 P1 PHASE DETECTOR 4A15
30
31
32
24
25
26
S6 RATE
RESET 3
RUN 1
2
J26-6
S5 RANGE
FREEZE 3
RUN 1
2
J26-7
S4 RETURN
NO TGT 3
TGT 1
2
S2 MODE
TEST 6
NORM 5
4
J8-9
J6-9
S3 ACCEL
POS 3
NEG 1
2
3
1
2
J11-17
J6-17
(NOTE 2)
TO RANGING SYSTEM (NOTE 2)
J21 P1 RANGE RATE D/A CONVERTER 4A17
J26 P1 UNIVERSAL BOARD 4A23
J27 P1 FINE/FINE DELAY 4A22
J15 P1 RANGE COUNTER 4A6
J16 P1 RANGE REGISTER A 4A8
J10 P1 SEARCH/TRACK CONTROL 4A10
J13 P1 RANGE RATE COUNTER B 4A12
J9 P1 RATE INTEGRATOR 4A14
J22 P1 RANGE D/A CONVERTER 4A16

NOTES:
1. REFER TO-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-14.
2. REFER TO RANGING SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-H.
3. DISTRIBUTION OF +5 VOLTS AND RETURN IS VIA BUSSES W1 AND W2.

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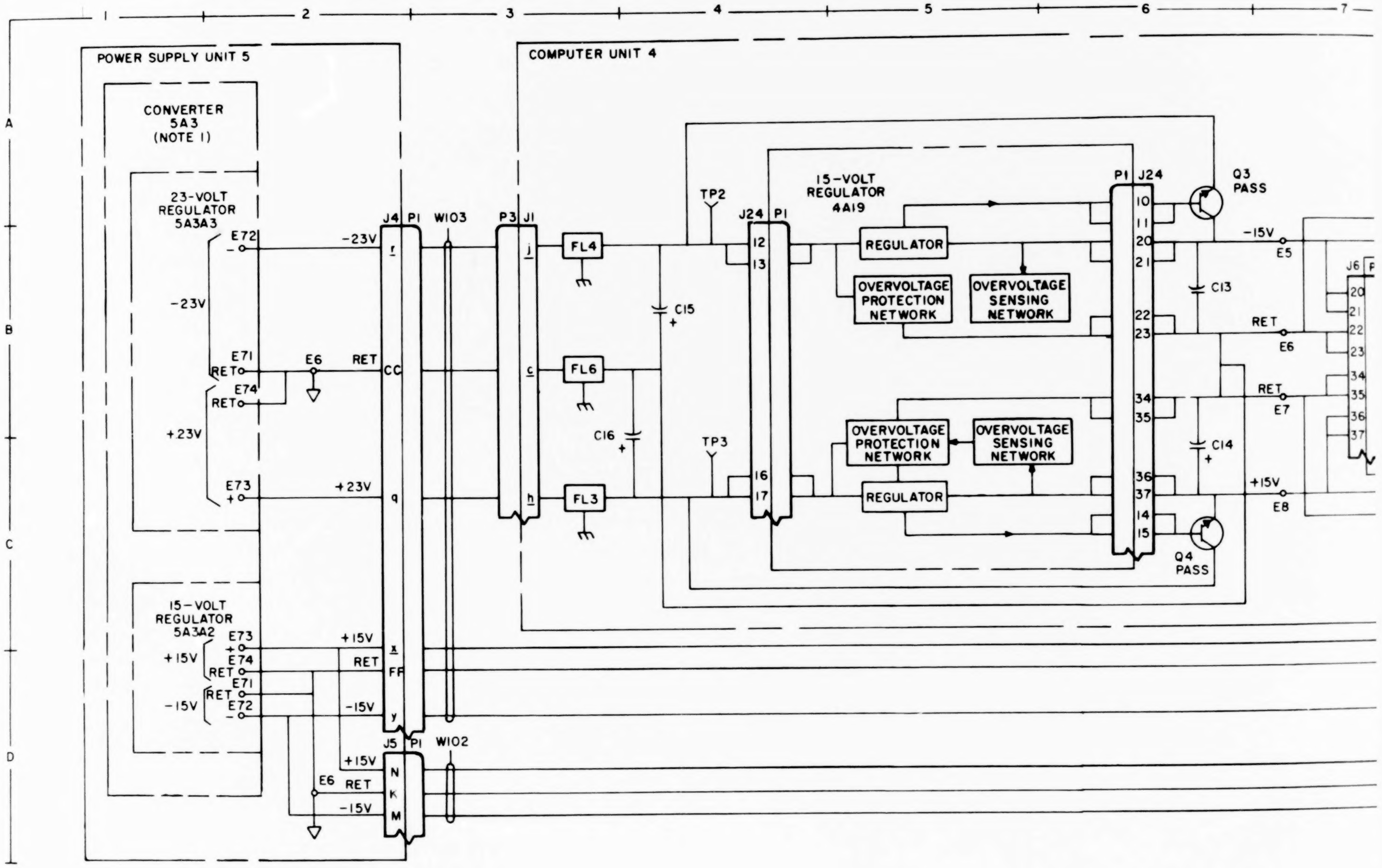
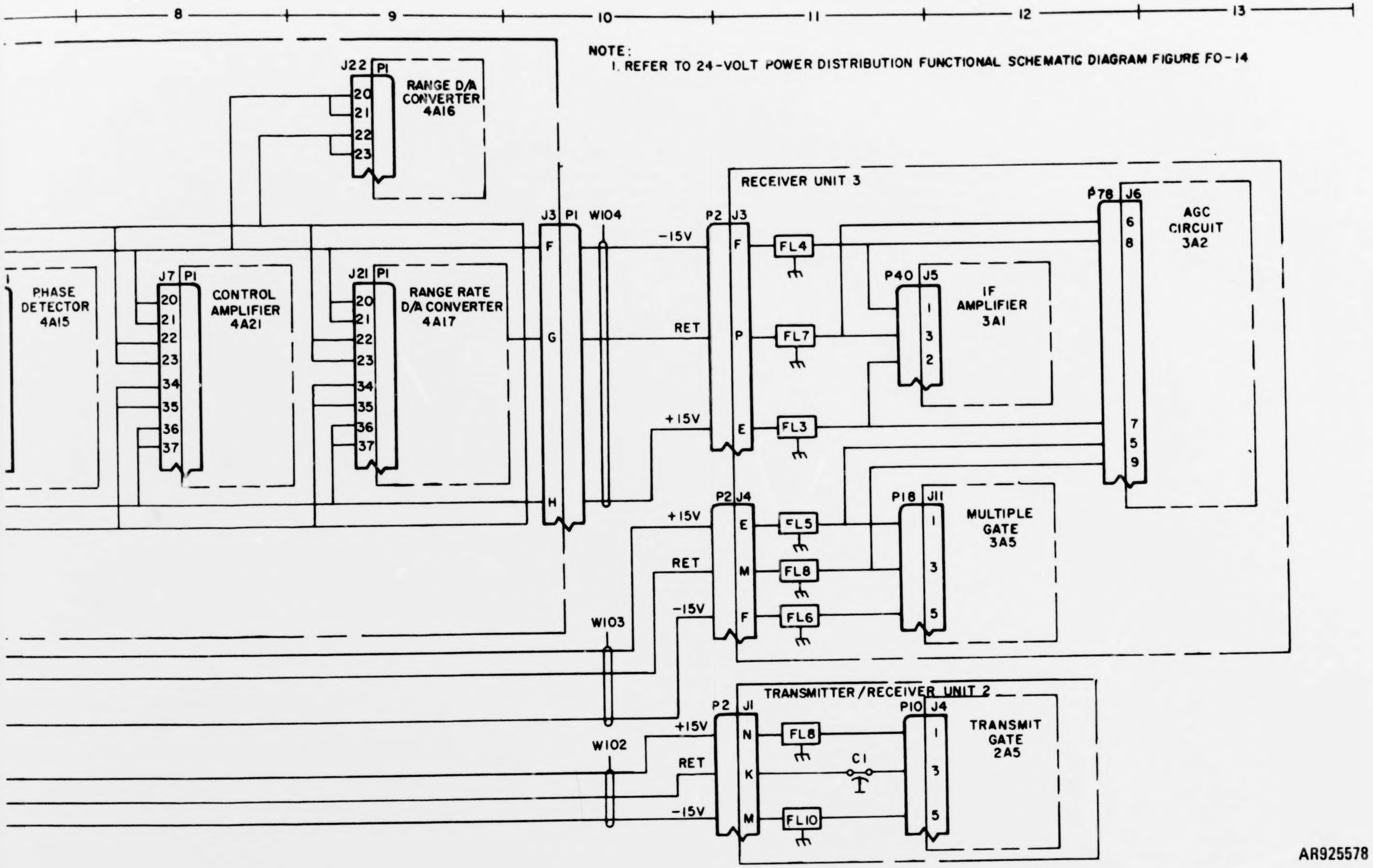
Figure FO-16. +6.5-volt and +5-volt power distribution, functional schematic diagram


1
2
3
4
5
6
7
A
B
C
D
POWER SUPPLY UNIT 5
CONVERTER 5A3 (NOTE 1)
23-VOLT REGULATOR 5A3A3
E72
-23V
E71
RET
E74
RET
+23V
E73
15-VOLT REGULATOR 5A3A2
+15V
-15V
E6
J4
P1
W103
r
CC
q
x
FF
y
J5
N
K
M
W102
COMPUTER UNIT 4
P3
J1
j
c
h
FL4
FL6
FL3
C15
C16
TP2
TP3
J24
12
13
16
17
15-VOLT REGULATOR 4A19
REGULATOR
OVERVOLTAGE PROTECTION NETWORK
OVERVOLTAGE SENSING NETWORK
10
11
20
21
22
23
34
35
36
37
14
15
Q3 PASS
Q4 PASS
C13
C14
E5
E7
E8
J6
20
21
22
23
34
35
36
37


8
9
10
11
12
13
J22 P1
20
21
22
23
RANGE D/A CONVERTER 4A16
PHASE DETECTOR 4A15
J7 P1
20
21
22
23
34
35
36
37
CONTROL AMPLIFIER 4A21
J21 P1
RANGE RATE D/A CONVERTER 4A17
J3 P1
W104
F
G
H
-15V
RET
+15V
RECEIVER UNIT 3
P2 J3
F
P
E
FL4
FL7
FL3
P40 J5
1
3
2
IF AMPLIFIER 3A1
P78 J6
6
8
7
5
9
AGC CIRCUIT 3A2
P2 J4
+15V
RET
-15V
E
M
F
FL5
FL8
FL6
P18 J11
1
3
5
MULTIPLE GATE 3A5
W103
W102
TRANSMITTER/RECEIVER UNIT 2
P2 J1
+15V
RET
-15V
N
K
M
FL8
FL10
C1
P10 J4
1
3
5
TRANSMIT GATE 2A5

NOTE:
1. REFER TO 24-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-14

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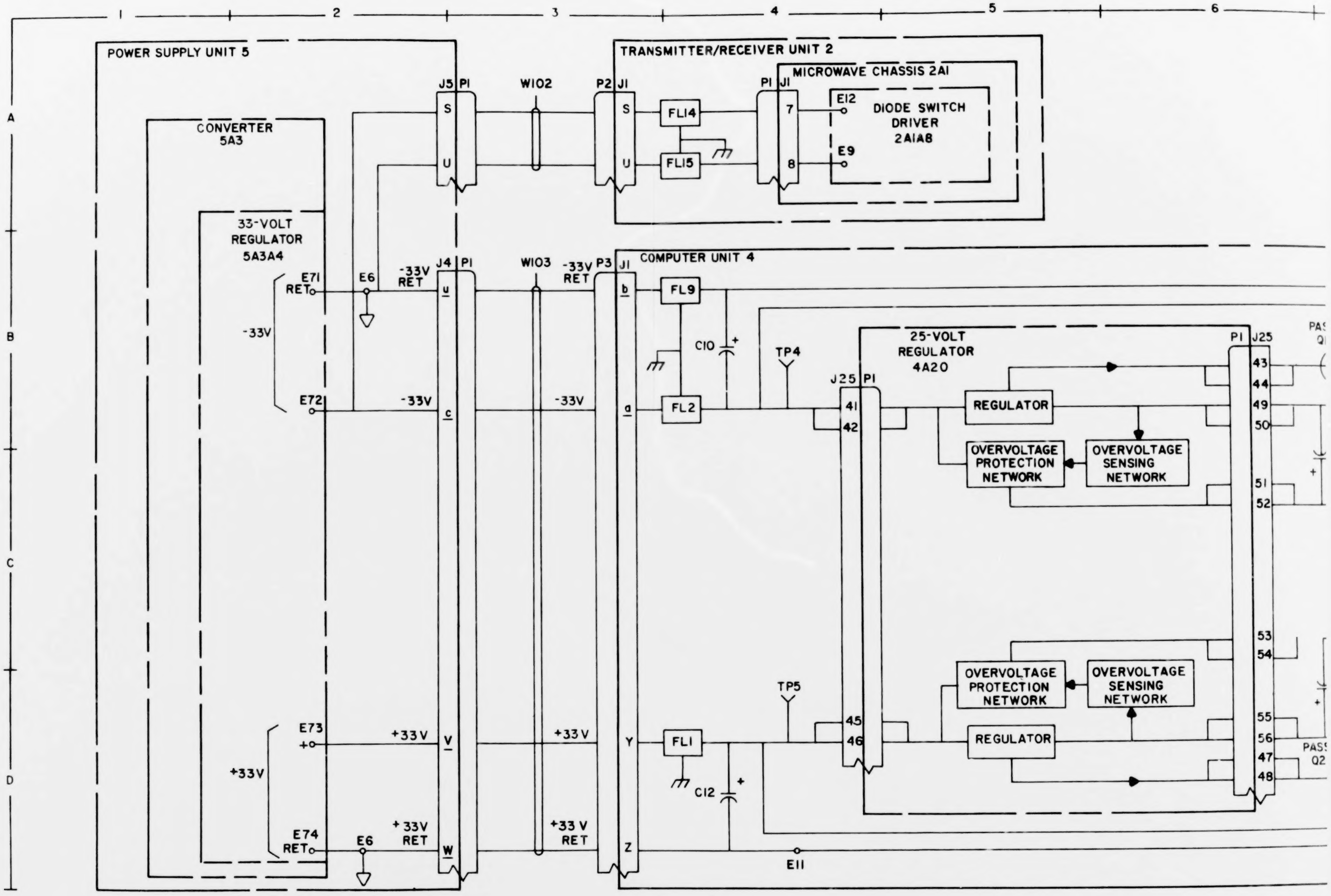
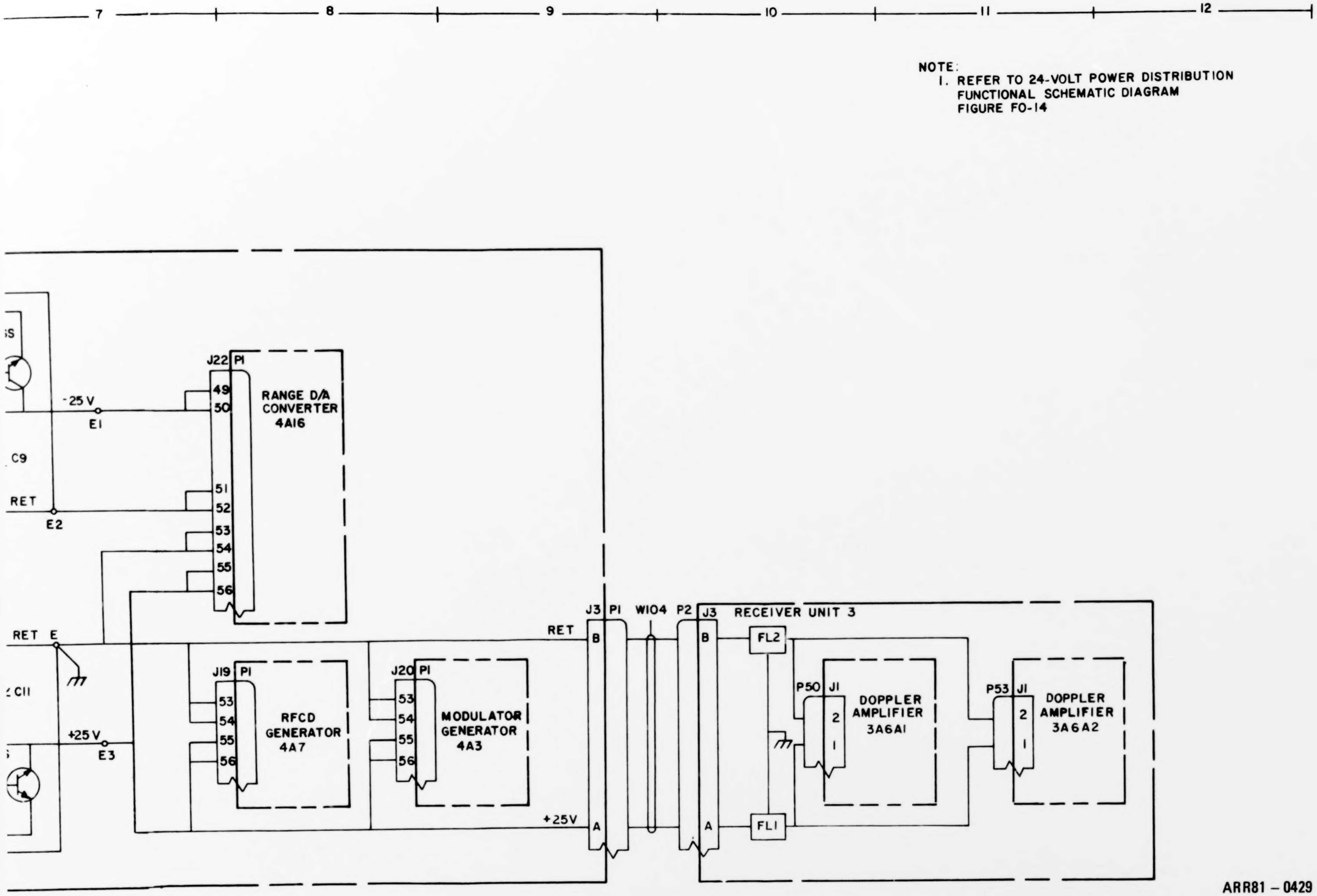
Figure FO-17. +23-volt and +15-volt power distribution, functional schematic diagram


1
2
3
4
5
6
A
B
C
D
POWER SUPPLY UNIT 5
CONVERTER
5A3
33-VOLT
REGULATOR
5A3A4
J5 P1
S
U
W102
P2 J1
TRANSMITTER/RECEIVER UNIT 2
FL14
FL15
P1 J1
7
8
MICROWAVE CHASSIS 2A1
E12
E9
DIODE SWITCH
DRIVER
2A1A8
E71
RET
-33V
E72
E6
-33V
RET
J4 P1
u
c
W103
-33V
RET
P3 J1
b
a
COMPUTER UNIT 4
FL9
C10
FL2
TP4
J25 P1
41
42
25-VOLT
REGULATOR
4A20
REGULATOR
OVERVOLTAGE
PROTECTION
NETWORK
OVERVOLTAGE
SENSING
NETWORK
P1 J25
43
44
49
50
51
52
53
54
55
56
47
48
E73
+
+33V
V
+33V
Y
FL1
C12
TP5
45
46
OVERVOLTAGE
PROTECTION
NETWORK
OVERVOLTAGE
SENSING
NETWORK
REGULATOR
E74
RET
E6
+33V
RET
W
+33 V
RET
Z
E11
+

NOTE:
1. REFER TO 24-VOLT POWER DISTRIBUTION FUNCTIONAL SCHEMATIC DIAGRAM FIGURE FO-14



7
8
9
10
11
12
S
-25 V
E1
C9
RET
E2
J22
P1
49
50
51
52
53
54
55
56
RANGE D/A CONVERTER 4A16
RET
E
C11
+25 V
E3
J19
P1
53
54
55
56
RFCD GENERATOR 4A7
J20
P1
53
54
55
56
MODULATOR GENERATOR 4A3
RET
+25V
J3
P1
B
A
W104
P2
J3
B
A
RECEIVER UNIT 3
FL2
FL1
P50
J1
2
1
DOPPLER AMPLIFIER 3A6A1
P53
J1
2
1
DOPPLER AMPLIFIER 3A6A2

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Figure FO-18. +25-volt and +33-volt power distribution, functional schematic diagram